Provisional Specifications

Provisional specification for the approval of type of electricity meters and auxiliary devices used in determining standardized legal unit of measure values outside a meter

1.0 Scope

This provisional specification applies to certain electricity meters and auxiliary devices submitted for approval pursuant to LMB-EG-07—Specifications for Approval of Type of Electricity Meters, Instrument Transformers and Auxiliary Devices. This specification will come into effect in accordance with the implementation period outlined in bulletin E-31.

2.0 Authority

This specification is issued under the authority of section 12 of the Electricity and Gas Inspection Regulations.

3.0 References

3.1 LMB-EG-07—Specifications for approval of type of electricity meters, instrument transformers and auxiliary devices (1986)

3.2 S-E-05—Specification for approval of type of electronic meters—Net metering

3.3 S-E-06—Specification for the approval of type of electricity meters and auxiliary devices—amendments to Measurement Canada specification LMB-EG-07

3.4 E-31—Implementation of policies and specifications relating to standardized electricity energy and demand legal units of measure
4.0 Background

This specification is established as a result of, and in accordance with, the Recommendations for Establishing Electricity LUM outside an Approved Meter—Final Report, and Measurement Canada's Decisions—VA JWG and LUM JWG Recommendations (2008-11-28). The approval aspects of those recommendations along with other related considerations have been adapted by the Complex Measurement Implementation JWG into the content of this specification, which is otherwise derived from specification S-E-06.

5.0 Amendments to sections of LMB-EG-07

5.1 Amendments to section 1 – Scope of LMB-EG-07

Reserved for future amendments to section 1 of LMB-EG-07.

5.2 Amendments to section 2 – Definitions of LMB-EG-07

5.2.1 Clause 2-23 is amended as follows:

Display.
A device or other means used to visually present the value of a measured quantity and other relevant information. It may take the form of an integral part of a meter or a separate display module.

5.2.2 Clause 2-34 is amended as follows:

Minimum current
The smallest load current for which a device must operate within specified error limits. The minimum current shall be taken to be 1% of $I_{\text{max}}$ (or less than 1% of $I_{\text{max}}$ if specified by the applicant).

5.2.3 Clause 2-59 is amended as follows:

Register (electronic)
A memory location in the meter where the value of a measured quantity expressed in legal units of measure is electronically recorded.

Register (mechanical)
A mechanical device integral to the meter where the value of a measured quantity expressed in legal units of measure is recorded and visually presented.

5.2.4 Clause 2-17 is amended as follows:

Demand interval (of an integrating meter or of a pulse recorder)
The specified duration of time on which a demand measurement is based.
5.2.5 Section 2 is amended by adding the following new definitions:

**Active energy**
Integral of active power over time (typically provided in units of watt hours). *(Énergie active)*

**Apparent energy**
Integral of apparent power over time (typically provided in units of VA hours). *(Énergie reactive)*

**Arithmetic totalization**
The addition of values having like units and direction of flow. *(Totalisation arithmétique)*

**Auxiliary device**
An independently housed device which is designed to work in conjunction with a source meter. *(Dispositif auxiliaire)*

**Auxiliary telemetering device**
An independently housed device which is designed to work in conjunction with a source meter or other measurement devices and systems for the purpose of making a measurement of, or obtaining the basis of a charge for the electricity or gas supplied. *(Dispositif de télémesure auxiliaire)*

**Conversion device or function**
A device or function that converts:

- legally relevant (LR) data to legal unit of measure (LUM) values,
- LUM values to new LUM values, and/or
- LR data to new LR data.

A conversion device may also perform totalization. *(Dispositif ou fonction de conversion)*

**Data initiation**
A function within a source meter that provides legally relevant data in a format which is to be further processed inside the generating source meter or outside. The data can be pulse counts, or solid state data which is representative of a legal unit of measure value. *(Génération de données)*

**Data initiator**
A component within a source meter which performs data initiation. *(Générateur de données)*

**Data multiplier**
A constant (similar to disc constant - Kh or pulse constant - Kp) which is applied to legally relevant data to establish a processed legal unit of measure value used for billing. *(Multiplicateur de données)*
Data recorder
An auxiliary device or source meter component that receives and stores energy legal unit of measure (LUM) values, or legally relevant (LR) energy data from one or more data initiator. The data recorder may:

- process LR data or LUM values;
- provide a means of indication;
- provide one or more interpretable outputs that can be converted into a processed legal unit of measure value.

A data recorder may also be a conversion device depending on its functionalities. (*Enregistreur de données*)

Data recording component
A component within a source meter that records and stores legally relevant data. (*Composant d’enregistrement de données*)

Distortion power
Power created by the product of voltage and current harmonics of unlike order. (*Puissance de distorsion*)

Function
An operation within a device which performs a specified action or results in a defined output. (*Fonction*)

Fundamental frequency
Nominal frequency of power generation. (*Fréquence fondamentale*)

Harmonic power
Power created by the product of voltage and current harmonics of like order. (*Puissance harmonique*)

Interval data
Contiguous time stamped legally relevant data that are stored in a data recorder. (*Données sur la période d’intégration*)

Legal unit of measure
A legal unit of measure as defined in the *Electricity and Gas Inspection Act* and Regulations and which can be used for the sale of electricity. (*Unité de mesure légale*)

Legally relevant data
Information that is approved and verified to be representative of a legal unit of measure. This must be combined with a multiplier or other function to conclude a legal unit of measure value. (*Données juridiquement pertinentes*)
Legal unit of measure value
A numerical value for a given amount of a legal unit of measure as defined above. (*Valeur en unités de mesure légales*)

Maximum demand register
A register in which the value of maximum demand is recorded. (*Registre de puissance appelée maximale*)

Means of indication
A mechanical register or a display. (*Dispositif d’indication*)

Netting
The combination of signed energy values of opposite direction of flow. Mathematically this is signed addition. (*Somme nette*)

Power
Active, reactive and apparent power quantities are defined by the following equations for sinusoidal voltage and current:

**Active power**
(Puissance active)

Watts: \( W = V \times I \cos \theta \)

**Reactive power**
(Puissance reactive)

Vars: \( var = V \times I \sin \theta \)

**Apparent power**
(Puissance apparente)

Volt-ampere (vectorial): \( VA_{vectorial} = \sqrt{W^2 + var^2} \)

where:  
\( V \) = voltage (root mean square)  
\( I \) = current (root mean square)  
\( \theta \) = phase angle between voltage and current fundamental waveforms

(*Puissance*)

Processed legal unit of measure value
A legal unit of measure value that has been derived outside a source meter from legally relevant data or from source legal unit of measure values, incorporating recognized units of measure, data multipliers and/or installation multipliers (as applicable), through a mathematical algorithm. (*Valeur en unités de mesure légales calculées*)
Reactive energy
Integral of reactive power over time (typically provided in units of var hours). (Énergie réactive)

Single-register, bi-directional meter
A meter that is specified as capable of measuring both positive and negative mean energy flow, and where the net result will be placed in a single register. The process is equivalent to that of netting. (Compteur bidirectionnel à registre simple)

Single-register, one direction only meter
A meter that is specified as capable of measuring and registering either positive mean energy flow only, or negative mean energy flow only. (Compteur unidirectionnel seulement à registre simple)

Sliding window
A type of demand response whereby at the end of each new subinterval, the value of the oldest subinterval demand value is discarded, and a new demand value is calculated based on the sum of energy registered in the most recent contiguous subintervals which comprise the total demand interval. (Fenêtre mobile)

Source legal unit of measure
A legal unit of measure for which measurement is approved and verified within a source meter. (Unité de mesure légale source)

Source legal unit of measure value
A legal unit of measure value that is capable of being indicated by a source meter. (Valeur en unités de mesure légales sources)

Source meter
A meter which has been approved and verified to provide indication of any legal unit of measure values and/or initiate legally relevant data which are enabled and identified on the Notice of Approval for that meter pattern. (Compteur source)

Test mode
A mode of operation or output which facilitates meter accuracy testing by introducing shorter test periods and/or greater resolution of readings. The output of a test mode feature or operation is not the output used in establishing the basis of a charge for electricity legal units of measure during normal meter operation. (Mode d’essai)

Time stamped
Refers to any data, values or intervals which have been subjected to time stamping. (Horodaté)

Time stamping
Applying a time attribute to legally relevant data, legal unit of measure values or contiguous time intervals. Time attribution can either be time of day (real time) or pre-set intervals (elapsed time). The time stamped data may then be transmitted and further processed outside of an approved device to establish demand processed legal unit of measure values. Time stamping may also be used to ensure energy totalization is performed on coincident values. (Horodatage)
Totalization
A generic term encompassing both arithmetic totalization and netting. (Totalisation)

Two-register, bi-directional meter
A meter that is specified as capable of measuring both positive and negative mean energy flow, as defined by the connection of the meter, and where the positive result and negative result are placed in different registers. This has historically been referred to in Canada as a "bi-directional meter". (Compteur bidirectionnel à double registre)

Var hour
Is defined as the integral reactive power over time at the fundamental frequency. (Varheure)

Var hour (delivered)
Is defined as var hours when the phase angle between the voltage and current is between 0° and 90° (quadrant I), and between 90° and 180° (quadrant II). (Varheure (livré))

Var hour (quadrant I)
Var hours delivered associated with watt hours delivered. The phase angle between the voltage and current is between 0° and 90° (quadrant I). (Varheure (quadrant 1))

Var hour (quadrant II)
Var hours delivered associated with watt hours received. The phase angle between voltage and current is between 90° and 180° (quadrant II). (Varheure (quadrant 2))

Var hour (quadrant III)
Var hours received associated with watt hours received. The phase angle between voltage and current is between 180° and 270° (quadrant III). (Varheure (quadrant 3))

Var hour (quadrant IV)
Var hours received associated with watt hours delivered. The phase angle between voltage and current is between 270° and 360° (quadrant IV). (Varheure (quadrant 4))

Var hour meter
An integrating instrument which measures reactive energy in var hours or in suitable multiples thereof. (Varheuremètre)

Var hour (received)
Is defined as var hours when the phase angle between voltage and current is between 180° and 270° (quadrant III), and between 270° to 360° (quadrant IV). (Varheure (reçu))

Volt-ampere hour
Is defined as the integral with respect to time of the apparent power based on continuous measurement of active and reactive power. (Voltampèreheure)

Volt-ampere hour (delivered)
Is defined as volt-ampere hours associated with watt hours (delivered) or when the phase angle between voltage and current is between 0° and 90° (quadrant I), and between 270° and 360° (quadrant IV). (Voltampèreheure (livré))
**Volt-ampere hour meter**
An integrating instrument which measures apparent energy in volt-ampere hours or in suitable multiples thereof. (*Voltampèreheuremètre*)

**Volt-ampere hour (received)**
Is defined as volt-ampere hours associated with watt hours (received) or when the phase angle between voltage and current is between 90° and 180° (quadrant II), and between 180° and 270° (quadrant III). (*Voltampèreheure (reçu]*)

**Watt hour**
Is defined as the integral of active power over time at the fundamental frequency. (*Wattheure*)

**Watt hour (delivered)**
Is defined as watt hours when the phase angle between voltage and current is between 0° and 90° (quadrant I), and between 270° and 360° (quadrant IV). (*Wattheure (livré]*)

**Watt hour (received)**
Is defined as watt hours when the phase angle between voltage and current is between 90° and 180° (quadrant II), and between 180° and 270° (quadrant III). (*Wattheure (reçu]*)

**Watt hour meter**
An integrating instrument which measures active energy in watt hours or in suitable multiples thereof. (*Wattheuremètre*)

5.2.6 The following definition in section 2 is modified as follows:

2-46 **Pulse initiator**
A data initiator used with a source meter to initiate pulses, the number of which is proportional to the quantity being measured.

5.3 Amendments to section 3 – General of LMB-EG-07

5.3.1 Clause 3-2.5.1 (a), which requires the word "line" to be indicated on single-phase self-contained meters is revoked.

5.3.2 Clause 3-2.7.4 is amended as follows:

3-2.7.4 **Multiplier.** The meter multiplier, if other than one (1.0), shall be marked permanently and prominently, on the register face.

**Note:** This requirement may be satisfied through physical marking or via electronic display.
5.3.3 Clause 3-2.7.5 is amended as follows:

3-2.7.5 Clock registers. The minimum diameter of clock dial circles shall be 10 mm. Each dial shall be divided into ten equal and clearly numbered divisions. Preferably, the dials shall be distinctly separated from each other. The gearing shall be such that a complete revolution of any pointer shall cause the adjacent pointer on the left to advance one division.

The dial centres shall be located so as to avoid any possibility of ambiguity in reading.

5.3.4 Clause 3-2.7.6 is amended to remove the requirement that all windows in the register face lie in a straight line and be of the same size.

3-2.7.6 Cyclometer registers. The test dial of a cyclometer register may be of either the drum or pointer type.

If the test dial is of the drum type, it shall be divided into ten equal numbered divisions, marked “test dial”, and a reference mark shall be provided on the register face for accurate reading.

The arrangement of the cyclometer drums and the cutouts on the register face shall be such that, with the exception of the fastest moving drum, one and only one digit is in full view, except when a drum is advancing from one position to another. The duration of this change period shall not exceed the time required for the fastest-moving drum to make one-tenth of a revolution.

The size and shape of any numerals shall be such that they are clearly legible.

5.3.5 Clause 3-2.7.7, “Multi-rate registers”, was revoked January 24, 2005, and replaced with PS-E-12—Provisional Specifications for the Approval of Type of Electricity Meters—Approval Requirements for Electricity Meters with Multiregister Metering Functions.

5.3.6 The title of clause 3-2.7 is amended as follows: Registers (mechanical).

5.3.7 Clause 3-2.9 is added to include requirements for electronic registers.

3-2.9 Registers (electronic). Electronic registers shall be non-volatile (they shall be capable of storing the last recorded value of a measured quantity if the meter is subjected to a power failure). Stored values shall not be overwritten and shall be capable of being retrieved upon restoration of power.

Electronic registers shall be capable of storing measurement information in a manner which provides for at least five digits of resolution at the display.
5.3.8 Clause 3-2.10 is added to include the requirement for a means to indicate the value of any legal unit of measure recorded by the meter.

3-2.10 **Means of indication.** The meter shall have one or more means of indication capable of accurately presenting or displaying the numerical value of each LUM for which the meter is approved. The means of indication shall clearly and unambiguously indicate to which specific LUM unit the value is attributed (including direction or quadrant as identified in the definitions). Indication of the specific LUM unit for which a value is being indicated may be presented on the meter nameplate in combination with the means of indication.

5.3.9 Clause 3-4.1 is amended as follows:

3-4.1 **Nameplates.** Every meter, instrument or device shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly visible from the front, with all covers in place:

(i) Name or mark of manufacturer

(ii) Type or designation

(iii) Serial number

(iv) Departmental approval number

(v) Operating temperature range

**Note:** This requirement shall only apply if the operating temperature range is less than -40 °C to +53 °C (i.e., intended for temperature-controlled locations). This requirement may be satisfied through physical marking or via electronic display.

3-4.1.1 Space shall be provided for affixing the inspection number.

3-4.1.2 Additional marking requirements applicable to various types of meters and devices are set forth in subsequent sections specific to them.

5.3.10 Clause 3-5.4 is amended by adding the following:

Polyphase meters incorporating a single-direction register or pulse output shall determine net polyphase registration resulting from the combined measurements of all elements of the meter prior to applying any detent function which prevents registration or pulse outputs when energy is applied in the reverse direction.

5.3.11 Clause 3-6 is added to section 3 to clarify the technical definition of a LUM when utilized in a legal manner pursuant to the *Electricity and Gas Inspection Act* and Regulations.
3-6   Definition of legal units of measure

Unless otherwise specified in this document, all LUMs assessed for the purposes of electricity meter approval shall be as defined in the International System of Units established by the General Conference on Weights and Measures. Defined and derived units of measure are prescribed in Schedule I of the Weights and Measures Act. Assessed LUMs shall be traceable to LUMs established by standard apparatus in custody of the Minister and which form part of the system of reference standards. (Refer to Schedule IV of the Weights and Measures Act.)

5.3.12 Clauses 3-2.8.5 and 3-2.8.6 are added to require the display of source legal unit of measure (SLUM) values.

3-2.8.5 The meter shall be capable of displaying corresponding energy register values for any SLUM which is approved to be used in establishing a processed legal unit of measure (PLUM) value.

3-2.8.6 The meter shall be capable of displaying corresponding demand register values for any SLUM which is approved to be used in establishing a PLUM value.

5.3.13 Clause 3-3.8 is added specifically for meters intended to be approved as source meters which produce LR data for the purposes of establishing a PLUM value.

3-3.8 Each meter to be approved as a source meter and which includes an internal data recording component shall have a real time clock which is capable of being synchronized to a common time reference.

5.3.14 Subsection 3-5.5 is added to clarify the application of performance requirements to meters based on direction of energy flow as follows:

3-5.5   Directional measurement

3-5.5.1 All performance requirements established in this specification apply in one direction of energy flow for a meter designated as "single-register, one direction only".

3-5.5.2 All performance requirements established in this specification apply in both directions of energy flow for meters designated as "single-register, bi-directional" and meters designated as "two-register, bi-directional".

5.4   Amendments to section 4 – Induction-type watt-hour meters of LMB-EG-07

5.4.1 Clause 4-2.1.1 was amended to remove the requirement that the direction of rotation be indicated by an arrow.

4-2.1.1 Direction of rotation. Viewed from above, the direction of rotation of the disc shall be counter-clockwise.
5.4.2 Clause 4-2.1.2.2 was amended to remove the requirement that every fifth division be longer than the others.

4-2.1.2.2 On self-contained single-phase meters, the disc shall carry the following markings, in black:

On the upper periphery, one hundred divisions, with every tenth division identified consecutively by the figures 10, 20, ... 90.

5.4.3 Clause 4-2.2.3 is amended to remove the requirement that the test dial be located out of line with other dials or be distinctly different in appearance. These requirements are redundant given the other requirements stipulated in this section.

4-2.2.3 Test dials. With the exception of meters equipped with a multi-rate register, all single-phase meters shall be provided with a special test dial for testing the register. In the case of polyphase meters, if the lowest reading dial or drum requires more than one hour to make one complete revolution when the meter under single-phase conditions specified in 3-5.1 (vi) is running on maximum load or 100 A, whichever is lesser, a test dial shall be provided.

The pointer of the test dial shall rotate at ten times the speed of the lowest reading dial or drum. There shall be no figures on the test dial but it shall be divided into ten equal divisions. The direction of rotation shall be indicated by means of an arrow.

5.4.4 Clause 4.3.2, “Test Links”, was revoked. Advances in technology have made it possible to facilitate the safe, effective and accurate testing of electricity meters without the use of test links. Electricity meters submitted to Measurement Canada for approval of type pursuant to specification LMB-EG-07 are not required to make use of test links.

5.4.5 Subsection 4-4 is amended as follows:

4-4.1 Nameplates. In addition to the requirements of subsection 3-4, every meter used for single-point metering shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly legible from the front, with all covers in place.

(i) Rated frequency

(ii) Rated voltage or voltages

Note: For 2½-element wye and 3-element meters, rated voltage is phase to neutral voltage.

(iii) Minimum and maximum rated currents

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a These requirements may be satisfied through physical marking or via the meter’s approved electronic display.
(iv) Disc constant

(v) Meter configuration notations, the following examples are recommended:

- 1-phase, 2-wire
- 1-phase, 3-wire
- 1-phase, 3-wire, 2-element
- 2-element network
- 2½ (2.5)-element wye or delta
- 3-element wye
- Auto detect

**Note:** Accepted symbols are Ø, EL, Y and Δ.

(vi) For single-phase transformer-type meters, the words "transformer type"

(vii) For transformer-rated meters,

1. Primary disc constant
2. Current transformer rating (e.g., 1000-5 A)
3. Voltage transformer rating (e.g., 600-120 V)

4-4.1.1 If the meter is fitted with accessories such as a reverse running detent or retransmitting contacts, this shall be specified on the nameplate or on an auxiliary plate, and a diagram of connections shall be provided.

5.5 **Amendments to section 5 – Induction-type var hour and q-hour meters of LMB-EG-07**

Reserved for future amendments to section 5 of LMB-EG-07.

5.6 **Amendments to section 6 – Static integrating meters of LMB-EG-07**

5.6.1 Subsection 6-2.2 was amended to clarify the requirements to facilitate efficient testing using conventional testing methodologies.

6-2.2 **Testing**

6-2.2.1 Each meter shall provide testing means analogous to counting the disc revolutions of an induction watt-hour meter. A means of testing shall be provided for each energy quantity measured (e.g., W·h, var·h, etc.).

6-2.2.2 Each meter shall provide pulses or some other form of discrete indication (e.g., light, KYZ, LCD, etc.) of energy accumulation registered by the meter. Each pulse or indication shall represent the same finite amount of energy.
6-2.2.3 Each meter shall provide discrete energy accumulation indications, including pulses, in sufficient numbers and frequency to ensure that the time required to test the meter is comparable to the time required to test an electromechanical energy meter of the same load rating and configuration.

6-2.2.4 Access to the means for testing shall be available with the meter cover in place, without the need to break the verification seal at either the operational location or at another location.

6-2.2.5 Specialized test equipment that may be required to test devices which have unique testing means and are compliant with the above requirements shall be provided free of charge by the contractor, as prescribed under section 19 of the Electricity and Gas Inspection Act. The specialized equipment shall also be provided during the approval process by the approval applicant.

6-2.2.6 A comparative registration assessment between the value of energy presented by the meter’s means of indication and the correlating value as determined through the meter’s test provision shall result in a relative difference of 0.3% or less. The test shall be performed at any one test point used to assess performance requirements applicable to the meter type.

6-2.2.7 All performance tests for active, reactive and apparent energy meters shall be performed in each direction or quadrant for which the meter is to be approved.

6-2.2.8 Each register of a meter that indicates the direction of energy attributed to that register shall be assessed to confirm that the direction indicated is representative of the input voltage and current to which the meter is subjected. Additionally, the meter shall be assessed to confirm that the registers do not record LUM values which are representative of any direction other than that which is the identified one.

5.6.2 Subsection 6-2.3 is added to include the requirements for approval of test mode for use during inspections of meters as follows:

6-2.3 Test mode

6-2.3.1 The test mode of electronic meters submitted to Measurement Canada for approval shall be evaluated to determine the extent to which it is suitable for meter verification testing.

6-2.3.2 The meter design schematics, operational block diagrams and other engineering and technical data shall be evaluated to confirm that there are no internal or external factors which can cause a difference between the resultant measured values obtained in the test and normal operating modes.

6-2.3.3 Each LUM evaluated for approval shall be evaluated in accordance with the requirements of clauses 6-2.3.4 and 6-2.3.5, as applicable, for each mode of operation.
6-2.3.4 The accuracy of the energy quantities shall be evaluated, as a minimum, in accordance with the test points and tolerance limits for each voltage, current and power factor specified in Table 1. For the purposes of evaluation, the voltage circuits shall be connected in parallel and current circuits connected in series, in a single-phase configuration.

Table 1 Test points and tolerances for energy quantities in test mode

<table>
<thead>
<tr>
<th>Reference value of voltage (V), current (I), power factor (PF)</th>
<th>Error tolerance limit of the difference between the test results in test mode and normal mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>V maximum, 25% I maximum, 50% PF</td>
<td>0.2</td>
</tr>
<tr>
<td>V maximum, 2.5% I maximum, 50% PF</td>
<td>0.2</td>
</tr>
</tbody>
</table>

6-2.3.5 The accuracy of the demand quantities shall be evaluated, as a minimum, in accordance with the test points and tolerance limits for each voltage, current and power factor specified in Table 2. For the purpose of evaluation, the voltage circuits shall be connected in parallel and current circuits connected in series, in a single-phase configuration.

Table 2 Test points and tolerances for demand quantities in test mode

<table>
<thead>
<tr>
<th>Reference value of voltage (V), current (I), power factor (PF)</th>
<th>Error tolerance limit of the difference between the test results in test mode and normal mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>V maximum, 50% I maximum, 50% PF</td>
<td>0.2</td>
</tr>
</tbody>
</table>

6-2.3.6 Where the test mode is found to comply with clauses 6-2.3.4 and 6-2.3.5, the Notice of Approval shall clearly indicate one of the following as applicable:

(a) The test mode is approved for the purpose of verifying the performance and accuracy of energy measurement functions which have been approved as legal units of measure in this Notice of Approval.

(b) The test mode is approved for the purpose of verifying the performance and accuracy of demand measurement functions which have been approved as legal units of measure in this Notice of Approval.

(c) The test mode is approved for the purpose of verifying the performance and accuracy of energy and demand measurement functions which have been approved as legal units of measure in this Notice of Approval.
5.6.3 Subsection 6-2 is amended to add clause 6-2.3 as follows:

6-2.3 Performance tests identified in section 6-4 shall be performed under sinusoidal, 60 hertz voltage and current conditions.

5.6.4 Clause 6-3.2 is amended to remove the requirement that the information be indicated in red. The information shall be permanently and prominently indicated, irrespective of colour.

5.6.5 Clause 6-3.3 is added to include the requirement that firmware versions be indicated as follows:

6-3.3 Firmware versions. Meter firmware versions shall be prominently indicated either on the meter nameplate or via the electronic display.

5.6.6 Clauses 6-3.4 and 6-3.5 were added to include requirements for nameplates as follows:

6-3.4 Nameplates for single customer meters. In addition to the requirements of section 3-4, every single customer meter shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly legible from the front, with all covers in place.

(i) Rated frequency

(ii) Rated voltage or voltages

Note: For 2½-element wye and 3-element meters, rated voltage is phase to neutral voltage.

(iii) Minimum and maximum rated currents

(iv) Disc constant

(v) Meter configuration notations, the following examples are recommended:

1-phase, 2-wire
1-phase, 3-wire
1-phase 3-wire, 2-element
2-element network
2½ (or 2.5)-element wye or delta
3-element wye
Auto detect

Note: Accepted symbols are Ø, EL, Y and Δ.

(vi) For single-phase transformer-type meters, the words "transformer type"
(vii) For transformer-rated meters,

(1) Primary disc constant\(^b\)
(2) Current transformer rating (e.g., 1000-5 A)\(^b\)
(3) Voltage transformer rating (e.g., 600-120 V)\(^b\)

In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter may be placed elsewhere on the meter, on condition that this same information also appears either inside or outside of the cover of an enclosure which shall be submitted as part of the approval of type application.

In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter may be placed on the terminal cover on condition that this same information also appears elsewhere on the meter itself. In such a case, as a minimum, the serial number affixed on the meter itself shall be visible when the meter is installed.

Meters approved with nameplate information not legible from the front of the meter shall be approved for installation only on the load side of the main switch or circuit breaker of the service for which the meter is installed. This installation restriction will be contained in the Notice of Approval.

6-3.4.1 If the meter is fitted with accessories such as a reverse running detent or retransmitting contacts, this shall be specified on the nameplate or on an auxiliary plate, and a diagram of connections shall be provided.

6-3.5 Nameplates for multiple customer metering systems. In addition to the requirements of section 3-4, every multiple customer metering system (MCMS) shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly legible from the front, with all covers in place.

(i) Rated frequency\(^c\)

(ii) Rated voltage or voltages

**Note:** For 2½-element wye and 3-element meters, rated voltage is phase to neutral voltage.

(iii) Minimum and maximum rated currents

(iv) Disc constant\(^c\)

---

\(^c\) These requirements may be satisfied through physical marking or via the meter’s approved electronic display.
(v) The actual configuration of each meter, as programmed in the MCMS. The following examples are recommended:

- 1-phase, 2-wire
- 1-phase, 3-wire, 2-element
- 2-element network
- 2-element, delta
- 3-element, wye

Note: Accepted symbols are Ø, EL, Y and Δ.

(vi) For single-phase transformer-type meters, the words "transformer type"

(vii) For transformer-rated meters,

1. Primary disc constant
2. Current transformer rating (e.g., 200-100 mA)
3. Voltage transformer rating (e.g., 600-120 V)

In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter shall be placed elsewhere on the meter on condition that this same information also appears either inside or outside of the cover of an enclosure which shall be submitted as part of the approval of type application.

Where the configuration information is not available on the nameplate or approved electronic display, the MCMS unit shall have a secondary nameplate, configuration chart or supporting documentation which provides the specific configuration information of each meter as programmed in the MCMS. The information shall be clearly identified as supporting documentation for the configuration of the device. The provision of configuration information may be satisfied through the use of an alternate electronic display such as a laptop or a PC connected to the MCMS.

If an MCMS has more than one configuration, all approved configurations specific to that model shall be on the nameplate. If an MCMS has the same configuration for each meter, the applicable configuration can be the only one to appear on the nameplate.

In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter may be placed on the terminal cover on condition that this same information also appears elsewhere on the meter itself. In such a case, as a minimum, the serial number affixed on the meter itself shall be visible when the meter is installed.

Meters approved with nameplate information not legible from the front of the meter shall be approved for installation only on the load side of the main switch or circuit breaker of the service for which the meter is installed. This installation restriction will be contained in the Notice of Approval.

6-3.5.1 If the meter is fitted with accessories such as a reverse running detent or retransmitting contacts, this shall be specified on the nameplate or on an auxiliary plate, and a diagram of connections shall be provided.
5.6.7 Subsection 6-4 is amended and subsections 6-5 to 6-13 are added to include additional performance requirements for active, reactive and apparent energy meters as follows:

### 6-4.15 Basic metering equations

Unless otherwise noted, all equations apply to fundamental frequency components only.

Watts: \( W = V \times I \cos \theta \)

Vars: \( \text{var} = V \times I \sin \theta \)

Volt-ampere (vectorial): \( VA_{\text{vectorial}} = \sqrt{W^2 + \text{var}^2} \)

where:  
- \( V \) = voltage  
- \( I \) = current  
- \( \theta \) = phase angle between voltage and current fundamental waveforms

### 6-5 Performance requirements for reactive energy meters

Reactive energy used in calculating apparent energy shall be measured directly and not calculated from other legal units of measure.

#### 6-5.1 Reactive energy allocated by direction or quadrant

6-5.1.1 Var hours delivered recorded by the meter may be allocated into a register identified as \( \text{Varhq}_1 \) where that reactive energy was applied concurrently with watt hours delivered. \( \text{Varhq}_1 \) shall be established by the following equation:

\[
\text{var } h_{q1} = \int \frac{W_p - |W_p|}{2W_p} \cdot \frac{\text{var}_p + |\text{var}_p|}{2} \, dt
\]

6-5.1.2 Var hours delivered recorded by the meter may be allocated into a register identified as \( \text{Varhrq}_2 \) where that reactive energy was applied concurrently with watt hours received. \( \text{Varhrq}_2 \) shall be established by the following equation:

\[
\text{var } h_{q2} = \int \frac{W_p - |W_p|}{2W_p} \cdot \frac{\text{var}_p + |\text{var}_p|}{2} \, dt
\]

6-5.1.3 Var hours received recorded by the meter may be allocated into a register identified as \( \text{Varhq}_3 \) where that reactive energy was applied concurrently with watt hours received. \( \text{Varhq}_3 \) shall be established by the following equation:

\[
\text{var } h_{q3} = \int \frac{W_p - |W_p|}{2W_p} \cdot \frac{\text{var}_p - |\text{var}_p|}{2} \, dt
\]
6-5.1.4 Var hours received recorded by the meter may be allocated into a register identified as Varh_{q4} where that reactive energy was applied concurrently with watt hours delivered. Varh_{q4} shall be established by the following equation:

\[
\text{var } h_{q4} = \frac{\int W_p + |W_p|}{2W_p} \cdot \frac{\text{var}_p - |\text{var}_p|}{2} dt
\]

6-5.1.5 No reactive energy allocated to a given varh register shall be recorded in any other varh registers.

6-6 Performance requirements for apparent energy meters - General

6-6.1 Meters shall establish apparent energy based on continuous measurement of active and reactive energy flow in all directions.

6-6.2 Meters shall establish apparent energy registration on the basis of the performance requirements specified for active and reactive energy and the following formula for apparent power:

\[
V A_p = \sqrt{W^2 + \text{var}^2}
\]

where: \( V A_p = \) apparent vector power

6-6.3 The following formula shall be the basis of all meter algorithms for apparent energy:

\[
V Ah r = \int V A_p dt
\]

6-6.4 Polyphase meters shall establish apparent energy on the basis of coincident active and reactive energy determined by the meter on a per phase basis. The following equations are provided as examples in the application of metering a 3-phase 4-wire wye service:

Watts: \( W = V \times I \cos \theta \)

Polyphase watts: \( W_p = V_a \times I_a \cos \theta_a + V_b \times I_b \cos \theta_b + V_c \times I_c \cos \theta_c \)

Vars: \( \text{var} = V \times I \sin \theta \)

Polyphase vars: \( \text{var}_p = V_a \times I_a \sin \theta_a + V_b \times I_b \sin \theta_b + V_c \times I_c \sin \theta_c \)

Volt-ampere vectorial: \( V A_v = \sqrt{W^2 + \text{var}^2} \)
Polyphase volt-ampere vectorial: \( VA_{P,v} = \sqrt{W_P^2 + var_P^2} \)

Polyphase volt-ampere energy: \( VA_h = \int \sqrt{W_P^2 + var_P^2} \, dt \)

where: \( V = \text{voltage} \)
\( I = \text{current} \)
\( \theta = \text{phase angle between voltage and current fundamental waveforms} \)

6-6.5 In the case of polyphase services other than 3-phase 4-wire wye, the meter equations shall similarly establish the watt and var polyphase quantities and then apply the vectorial VA equation in 6-6.4 above.

6-6.6 The applicant shall provide documentation which supports the algorithm used to establish apparent energy registration.

6-7 Performance requirements for apparent energy meters under unbalanced loads

Polyphase meters shall be assessed for performance under unbalanced polyphase loads. The applied test current shall be such that each phase is subject to a value different than the other one or two (as applicable) phases. Similarly, the power factor for each phase shall be set to a value different from the other one or two (as applicable) phases. Errors shall not exceed +/-0.75% while any current value from minimum to maximum is applied and at any power factor between 0.5 lead and 0.5 lag.

6-8 Performance requirements for apparent energy meters allocated by direction

6-8.1 Apparent energy recorded by the meter shall be allocated into a register identified as VAh (del) where that apparent energy was applied concurrently with watt hours delivered. In addition, the var energy used to calculate VAh shall also be coincident with watt hours delivered.

6-8.1.1 The value for fundamental VAh (del) shall be established on the basis of the following equation:

\[ VAh (del) = \int \sqrt{W_{del}^2 + (var_{q1} + var_{q4})^2} \, dt \]

6-8.2 Apparent energy recorded by the meter shall be allocated into a register identified as VAh (rec) where that apparent energy was applied concurrently with watt hours received. In addition, the var energy used to calculate VAh shall also be coincident with watt hours received.

6-8.2.1 The value for fundamental VAh (rec) shall be established on the basis of the following equation:
\[ VAh\ (rec) = \int \sqrt{W_{rec}^2 + (var_{q2} + var_{q3})^2}\ dt \]

6-8.3 No apparent energy pursuant to 6-8.1 shall be recorded in a VAh (rec) register and no apparent energy pursuant to 6-8.2 shall be recorded in a VAh (del) register.

6-9 Directional quantities for active energy

Directional quantities for active energy shall be determined on the basis of the following equations:

\[ W_{del} = EI \cos \theta \ for \ 0 < \theta < 90 \ degrees \ or \ 270 < \theta < 360 \ degrees \]

\[ W_{rec} = EI \cos \theta \ for \ 90 < \theta < 270 \ degrees \]

6-10 Energy meter performance under harmonic influence

6-10.1 General

Energy meters shall register energy only on the basis of fundamental frequency. Registration shall be within specified tolerances for non-sinusoidal load conditions containing voltage and current harmonic content as defined in section 6-10.2 below.

6-10.2 Active energy meter performance requirements under harmonic influence

6-10.2.1 Watt hour energy meter registration shall not exceed specified tolerance under the influence of harmonic conditions simulated by the following non-sinusoidal waveforms:

(a) 90-degree phase fired waveform
(b) Quadriform waveform
(c) Peaked waveform
(d) Pulsed waveform
(e) Severe voltage pulse waveform
(f) Even harmonic waveform
(g) Integral cycle load control test waveform
Unless otherwise noted, harmonic test waveforms shall be generated at amplitudes having an error not greater than 1% of the fundamental or 25% of the test harmonic amplitude.

6-10.2.2 Test waveforms are defined by the following general equations:

\[ I = \sum_{n=1}^{N} I_p \sin(n2\pi60t + \varphi_n) \]

where: \( n \) = harmonic number
\( I_p = 1.414 I_{\text{test}} \)
\( \varphi_n = \text{harmonic phase} \)
\( I_{\text{test}} = 25\% I_{\text{max}} \)

\[ V = \sum_{n=1}^{N} V_p \sin(n2\pi60t + \theta_n) \]

where: \( n \) = harmonic number
\( V_p = 1.414 V_{\text{rated}} \)
\( \theta_n = \text{harmonic phase} \)

**Note:** All test waveforms resulting from a combination of harmonic and fundamental content shall not exceed 1.414 times the meter’s maximum rating for voltage or current respectively.

6-10.2.3 A 90-degree phase fired test waveform shall be applied to the current circuits of the meter while a sinusoidal voltage at rated voltage and the fundamental frequency shall be applied to the voltage circuits. The phase fired current test waveform is zero from 0 to 90 degrees, 50% of \( I_{\text{max}} \) from 90 to 180 degrees, zero from 180 to 270 degrees, and 50% of \( I_{\text{max}} \) from 270 to 360 degrees. The current test waveform and information regarding the generation of this waveform can be found in ANSI C12.20 (where: \( I_{\text{test}} = 25\% I_{\text{max}} \) and \( I_{\text{ref}} = 50\% I_{\text{max}} \)).

6-10.2.4 Waveforms comprising harmonics having a phase and amplitude indicated in the table below shall be applied to the voltage and current circuits of the meter.
Quadriform waveform parameters

<table>
<thead>
<tr>
<th>Quadriform waveform – harmonic number</th>
<th>Current amplitude %I_test</th>
<th>Current phase angle</th>
<th>Voltage amplitude %V_rated</th>
<th>Voltage phase angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100%</td>
<td>0°</td>
<td>100%</td>
<td>0°</td>
</tr>
<tr>
<td>3</td>
<td>30%</td>
<td>0°</td>
<td>3.8%</td>
<td>180°</td>
</tr>
<tr>
<td>5</td>
<td>18%</td>
<td>0°</td>
<td>2.4%</td>
<td>180°</td>
</tr>
<tr>
<td>7</td>
<td>14%</td>
<td>0°</td>
<td>1.7%</td>
<td>180°</td>
</tr>
<tr>
<td>11</td>
<td>9%</td>
<td>0°</td>
<td>1.0%</td>
<td>180°</td>
</tr>
<tr>
<td>13</td>
<td>5%</td>
<td>0°</td>
<td>0.8%</td>
<td>180°</td>
</tr>
</tbody>
</table>

6-10.2.5 Waveforms comprising harmonics having a phase and amplitude as defined in the table below shall be applied to the voltage and current circuits of the meter.

Peaked waveform parameters

<table>
<thead>
<tr>
<th>Harmonic number</th>
<th>Current amplitude %I_test</th>
<th>Current phase angle</th>
<th>Voltage amplitude %V_rated</th>
<th>Voltage phase angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100%</td>
<td>0°</td>
<td>100%</td>
<td>0°</td>
</tr>
<tr>
<td>3</td>
<td>30%</td>
<td>180°</td>
<td>3.8%</td>
<td>0°</td>
</tr>
<tr>
<td>5</td>
<td>18%</td>
<td>0°</td>
<td>2.4%</td>
<td>180°</td>
</tr>
<tr>
<td>7</td>
<td>14%</td>
<td>180°</td>
<td>1.7%</td>
<td>0°</td>
</tr>
<tr>
<td>11</td>
<td>9%</td>
<td>180°</td>
<td>1.0%</td>
<td>0°</td>
</tr>
<tr>
<td>13</td>
<td>5%</td>
<td>0°</td>
<td>0.8%</td>
<td>180°</td>
</tr>
</tbody>
</table>

6-10.2.6 Waveforms comprising harmonics having a phase and amplitude as indicated in the table below shall be applied to the voltage and current circuits of the meter.
### Pulsed waveform parameters

<table>
<thead>
<tr>
<th>Harmonic number</th>
<th>Current amplitude $%I_{\text{test}}$</th>
<th>Current phase angle</th>
<th>Voltage amplitude $%V_{\text{rated}}$</th>
<th>Voltage phase angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>180</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>0</td>
<td>2.4</td>
<td>180</td>
</tr>
<tr>
<td>7</td>
<td>40</td>
<td>180</td>
<td>1.7</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>22</td>
<td>0</td>
<td>1.5</td>
<td>180</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>180</td>
<td>1.1</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>0</td>
<td>0.8</td>
<td>180</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>180</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>0</td>
<td>0.4</td>
<td>180</td>
</tr>
<tr>
<td>19</td>
<td>0.5</td>
<td>180</td>
<td>0.3</td>
<td>0</td>
</tr>
</tbody>
</table>

6-10.2.7 Meters shall be subject to a voltage waveform defined by the parameters shown in the table below. The value of $I_{\text{test}}$ shall be such that the peak current resulting from the sum of the current waveforms identified below does not exceed the peak of $I_{\text{max}}$ at the fundamental frequency.

### Severe voltage waveform parameters

<table>
<thead>
<tr>
<th>Harmonic number</th>
<th>Current amplitude $%I_{\text{test}}$</th>
<th>Current phase angle</th>
<th>Voltage amplitude $%V_{\text{rated}}$</th>
<th>Voltage phase angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>180</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>0</td>
<td>6</td>
<td>180</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>180</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>180</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>180</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>0</td>
<td>0.8</td>
<td>180</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>180</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>0</td>
<td>0.4</td>
<td>180</td>
</tr>
<tr>
<td>19</td>
<td>0.5</td>
<td>180</td>
<td>0.3</td>
<td>0</td>
</tr>
</tbody>
</table>
6-10.2.8 Meters shall be subject to a voltage waveform defined by the parameters shown in the table below and a sinusoidal current waveform at $I_{\text{test}}$.

### Even harmonic test waveform parameters

<table>
<thead>
<tr>
<th>Harmonic</th>
<th>Voltage amplitude % $V_{\text{rated}}$</th>
<th>Phase</th>
<th>Current amplitude % $I_{\text{test}}$</th>
<th>Phase</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100.000</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>0</td>
<td>40</td>
<td>0</td>
<td>4.000</td>
</tr>
</tbody>
</table>

6-10.2.9 Meters shall be subject to a sinusoidal waveform at rated voltage and current waveforms defined by the parameters in the table below.

### Multiple zero crossing current parameters

<table>
<thead>
<tr>
<th>Harmonic</th>
<th>Voltage amplitude % $V_{\text{rated}}$</th>
<th>Phase</th>
<th>Current amplitude % $I_{\text{test}}$</th>
<th>Phase</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100.000</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5 ± 1</td>
<td>90 ± 2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>18 ± 2</td>
<td>-160 ±2</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>10 ± 2</td>
<td>110 ±2</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>66 ± 3</td>
<td>130 ±2</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>50 ± 3</td>
<td>50 ± 2</td>
<td>0</td>
</tr>
</tbody>
</table>

6-10.2.10 Meters shall be subject to a voltage waveform defined by the parameters shown in the table below and a sinusoidal current waveform at $I_{\text{test}}$.

### Multiple zero crossing voltage waveform parameters

<table>
<thead>
<tr>
<th>Harmonic</th>
<th>Voltage amplitude % $V_{\text{rated}}$</th>
<th>Phase</th>
<th>Current amplitude % $I_{\text{test}}$</th>
<th>Phase</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100.000</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>20 ± 2</td>
<td>155 ±5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>25 ± 4</td>
<td>155 ±5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

6-10.2.11 Meters shall be subject to an integral cycle load control waveform test using a sinusoidal voltage waveform and a current waveform as follows:
(a) The current waveform shall have amplitude two times higher than $I_{\text{test}}$ and shall be asinusoidal signal at the fundamental frequency which is switched on and off every second period.

(b) The measured energy using the test waveform current shall be compared with energy from reference waveforms at $I_{\text{test}}$.

### 6-10.3 Limits of error

Except for the case of $\text{VA}_{\text{rms/hr}}$ meters, errors shall be established on the basis of registration of the fundamental content only (e.g. 60 Hz sine wave).

#### 6-10.3.1
Meters subjected to the 90-degree phase-fired test waveform described under 6-10.2.3 shall register energy with an error not exceeding $\pm 0.8\%$.

#### 6-10.3.2
For any test condition indicated in the tables of clauses 6-10.2.4 to 6-10.2.8, the meter registration shall not exceed $\pm 0.6\%$ error.

#### 6-10.3.3
For any test condition indicated in the tables of clauses 6-10.2.9 or 6-10.2.10, the meter registration shall not exceed $\pm 0.5\%$ error.

#### 6-10.3.4
Meters subjected to the integral cycle load control waveform test described under 6-10.2.11 shall register energy with an error not exceeding $\pm 1.5\%$.

### 6-11 Reactive energy meter performance under harmonic influence

#### 6.11.1 General

Var hour energy meters shall register energy only on the basis of the fundamental frequency. Registration shall be within specified tolerances for applicable non-sinusoidal load conditions containing voltage and current harmonic content as defined in the clauses of 6-10.2 above and 6-11.2 below.

#### 6-11.2 Performance requirements under harmonic influence

Var hour energy meter registration shall not exceed specified tolerance under the influence of harmonic conditions simulated by the following non-sinusoidal waveforms:

(a) Quadriform waveform

(b) Peaked waveform

(c) Pulsed waveform

Unless otherwise noted, harmonic test waveforms shall be generated at amplitudes having an error not greater than 1% of the fundamental or 25% of the test harmonic amplitude.
6-11.2.1 Test waveforms are defined by the general equations identified pursuant to clause 6-10.2.2 above. Test waveform parameters are defined by the tables pursuant to clauses 6-10.2.4 to 6-10.2.6.

**Note:** All current phase angles identified in the referenced tables shall be offset by 90 degrees lagging.

6-11.3 **Limits of error**

6-11.3.1 For any test condition indicated in the tables of 6-10.2.4 to 6-10.2.6, the meter registration shall not exceed 0.6%.

6-12 **Apparent energy (fundamental) meter performance under harmonic influence**

6-12.1 Compliance for metering VA hour energy on the basis of the fundamental frequency only shall be established on the basis of both functionality testing and written attestations of compliance.

6-12.2 VA hour energy registration shall be within the specified tolerances for non-sinusoidal load conditions containing voltage and current harmonic content, as defined in clause 6-10.2 above.

**Note:** All current phase angles identified in the referenced tables shall be offset by 45 degrees lagging.

6-12.3 Full disclosure of algorithms and documentation relating to meter design in support of attestations of compliance shall be provided as requested by Measurement Canada.

6-12.4 Documentation shall clearly show that VA hour energy is established in accordance with the requirements of section 6-6 and registration only includes energy from fundamental frequency voltage and current components.

6-12.5 Attestations of compliance shall originate from an authorized signing authority who has been appropriately designated for these purposes as part of the pattern approval process.

6-12.6 All applicant and manufacturer attestations shall serve as supplementary records of compliance and shall be maintained as permanent records in a device’s pattern approval file.
6-13  Apparent energy (VA<sub>rms</sub>) meter performance under harmonic influence

6-13.1 VA<sub>rms</sub> hour meters which are capable of measuring apparent energy that includes energy at the fundamental frequency plus harmonic frequencies shall comply with the requirements of all clauses below. Compliance shall be established on the basis of both functionality testing and written attestations of compliance.

6-13.2 VA<sub>rms</sub> hour energy meters shall establish apparent energy registration on the basis the following formula for apparent power:

\[ \text{VA}_{\text{rms}} = V_{\text{rms}} \times I_{\text{rms}} \]

where: VA<sub>rms</sub> = apparent power including harmonic power

6-13.2.1 The following formula shall be the basis of all meter algorithms for apparent energy where registration includes harmonic content:

\[ \text{VA}_{\text{rms,hr}} = \int \text{VA}_{\text{rms}} \, dt \]

6-13.3 VA<sub>rms</sub> hour meter energy registration shall be within specified tolerances for non-sinusoidal load conditions containing voltage and current harmonic content as defined in clause 6-10.2 above.

Note: All current phase angles identified in the referenced tables shall be offset by 45 degrees lagging.

6-13.4 Full disclosure of algorithms and documentation relating to meter design in support of attestations of compliance shall be provided as requested by Measurement Canada. Documentation shall clearly show that VA<sub>rms</sub> hour energy is established in accordance with the requirements of section 6-13.

6-13.5 Attestations of compliance shall originate from an authorized signing authority who has been appropriately designated for these purposes as part of the pattern approval process.

6-13.6 All applicant and manufacturer attestations shall serve as supplementary records of compliance and shall be maintained as permanent records in a device’s pattern approval file.
5.7 Amendments to section 7 – Demand meters of LMB-EG-07

5.7.1 Clause 7-2.1.2.1 is amended as follows:

7-2.1.2.1 General. All clock-type indicators shall have at least three dials.

The minimum diameter of clock dial circles shall be 10 mm.

Each dial shall be divided into ten equal and clearly numbered divisions. The gearing shall be such that a complete revolution of any pointer shall cause the adjacent pointer to the left to advance one division.

5.7.2 Clause 7-2.1.3.1 is amended as follows:

7-2.1.3.1 General. All cyclometer-type demand indicators shall have at least three digits.

The size and shape of the numerals shall be such that they are clearly legible.

The arrangement of the cyclometer drums and the cutouts on the demand-indicator face shall be such that, with the exception of the fastest moving drum, one and only one digit is in full view at all times except when the drum is advancing from one position to the next.

5.7.3 Clause 7-3.3, “Test Links”, has been revoked. Advances in technology have made it possible to facilitate the safe, effective and accurate testing of electricity meters without the use of test links. Electricity meters submitted to Measurement Canada for approval of type pursuant to specification LMB-EG-07 are not required to make use of test links.

5.7.4 Subsection 7-4 is amended as follows:

7-4 Markings

7.4.1 Nameplate marking. In addition to the requirements of subsection 4-4, demand meter nameplates shall bear the following information:

(i) Response period or demand interval

Note: This requirement may be satisfied through physical marking or via electronic display.

(ii) Full-scale demand rating

(iii) Single-phase test constant (if applicable)

(iv) All information required to determine the demand from the meter indication
7-4.1.1 The marking shall be indelible, distinct and visible from outside the meter with its cover in place.

5.8 Amendments to section 8 – Induction type loss meters of LMB-EG-07

5.8.1 Subsection 8-4 is amended as follows:

8-4 Markings

8-4.1 Nameplate marking. In addition to the requirements of subsection 4-4, every meter shall bear, as appropriate, the following information:

(i) Auxiliary supply voltage
(ii) For secondary rated meters, the disc constant in $A^2 \cdot h$ per revolution
(iii) For primary rated meters,
   (1) Primary line resistance
   (2) Primary disk constant in $kW \cdot h$ per revolution

5.9 Amendments to section 9 – Static loss meters of LMB-EG-07

5.9.1 Subsection 9-3 “Markings” is amended as follows:

9-3 Markings

9-3.1 Nameplate marking. In addition to the requirements of subsection 8-4, every meter shall bear, as appropriate, the following information:

(i) Voltage and frequency of auxiliary power supply
(ii) For secondary rated meters, the test constant and pulse constant in $A^2 \cdot h$ per pulse

5.9.2 Subsection 9-4.11 is added as follows:

9-4.11 Static loss meter performance under harmonic influence – General

9-4.11.1 Static loss (ampere-squared hour) meters ($I^2 h$) shall register energy only on the basis of current at the fundamental frequency. Registration shall be within specified tolerances for non-sinusoidal load conditions containing current harmonic content as defined in clause of 9-4.11.2 below.
9-4.11.2 The $I^2 t$ hour energy meter registration shall not exceed specified tolerances under the influence of harmonic conditions simulated by the following non-sinusoidal waveforms:

(a) 90-degree phase fired waveform
(b) Quadriform waveform
(c) Peaked waveform
(d) Pulsed waveform
(e) Severe voltage pulse waveform
(f) Even harmonic waveform
(g) Integral cycle load control waveform

Unless otherwise noted, harmonic test waveforms shall be generated at amplitudes having an error not greater than 1% of the fundamental or 25% of the test harmonic amplitude.

9-4.11.3 Test waveforms are defined by the general equations established in clause 6-10.2.2.

9-4.11.4 A 90-degree phase fired test waveform shall be applied to the current circuits of the meter while a sinusoidal voltage at rated voltage and the fundamental frequency shall be applied to the voltage circuits. The phase fired current test waveform is zero from 0 to 90 degrees, 50% of $I_{\text{max}}$ from 90 to 180 degrees, zero from 180 to 270 degrees, and 50% of $I_{\text{max}}$ from 270 to 360 degrees. The current test waveform and information regarding the generation of this waveform can be found in ANSI C12.20 (where: $I_{\text{test}} = 25\%$ of $I_{\text{max}}$ and $I_{\text{ref}} = 50\%$ of $I_{\text{max}}$).

9-4.11.5 Quadriform waveforms comprising harmonics having a phase and amplitude as indicated in the table of clause 6-10.2.4 shall be applied to the voltage and current circuits of the meter.

9-4.11.6 Peaked waveforms comprising harmonics having a phase and amplitude as indicated in the table of clause 6-10.2.5 shall be applied to the voltage and current circuits of the meter.

9-4.11.7 Pulsed waveforms comprising harmonics having a phase and amplitude as indicated in the table of clause 6-10.2.6 shall be applied to the voltage and current circuits of the meter.

9-4.11.8 Meters shall be subject to a severe voltage waveform defined by the parameters shown in the table of clause 6-10.2.7. The value of $I_{\text{test}}$ shall be such that the peak current resulting from the sum of the current waveforms identified below does not exceed the peak of $I_{\text{max}}$ at the fundamental frequency.
9-4.11.9 Meters shall be subject to a voltage waveform defined by the parameters shown in the table of clause 6-10.2.8 and a sinusoidal current waveform at $I_{\text{test}}$.

9-4.11.10 Meters shall be subject to a sinusoidal waveform at rated voltage and current waveforms defined by the parameters in the table of clause 6-10.2.9.

9-4.11.11 Meters shall be subject to a voltage waveform defined by the parameters in the table of clause 6-10.2.10 and a sinusoidal current waveform at $I_{\text{test}}$.

9-4.11.12 Meters shall be subject to integral cycle load control waveform test defined by the parameters established in clause 6-10.2.11.

9-4.12 Static loss meter performance under harmonic influence – Limits of error

9-4.12.1 Meters subjected to the 90-degree phase-fired test waveform described under 9-4.11.4 shall register energy with an error not exceeding +/-0.8%.

9-4.12.2 For any test condition indicated in the tables of 9-4.11.5 to 9-4.11.9, the meter registration shall not exceed +/-0.6% error.

9-4.12.3 For any test condition indicated in the tables of 9-4.11.10 or 9-4.11.11, the meter registration shall not exceed +/-0.5% error.

9-4.12.4 Meters subjected to the sub-harmonic waveform described under 6-10.2.11 shall register energy with an error not exceeding +/-1.5%.

5.10 Amendments to section 10 – Transducers of LMB-EG-07

Reserved for future amendments to section 10 of LMB-EG-07.

5.11 Amendments to section 11 – Null balancing instruments of LMB-EG-07

Reserved for future amendments to section 11 of LMB-EG-07.

5.12 Amendments to section 12 – Pulse devices of LMB-EG-07

5.12.1 Subsection 12-4 is amended as follows:

12-4 Markings

12-4.1 Nameplate marking. In addition to the requirements of subsection 3-4.1, every pulse device shall bear the information in sub-paragraphs 12-4.1.1 and 12.4.1.2, as appropriate.
12-4.1.1 Pulse initiators (information may be on the initiator or host meter)

(i) Pulse initiator output constant Kp

12-4.1.2 Relays and pulse amplifiers

(i) Type of input (2 or 3-wire)

(ii) Type of output (2 or 3-wire)

(iii) Voltage and frequency of the auxiliary power supply (if applicable)

(iv) Rated or maximum voltage and frequency (pulses per unit time) of input pulses

(v) Minimum pulse width, if critical to the operation of the device

(vi) Connection diagram

12-4.1.3 Totalizers

(i) Input to output pulse ratio (pre-scalar unit)

(ii) Number of additive and subtractive elements. If both are present, each shall be clearly identified.

(iii) Type of input (2-wire or 3-wire)

(iv) Type of output (2-wire or 3-wire)

(v) Voltage and frequency of the auxiliary power supply

(vi) Rated or maximum voltage and frequency (pulses per unit time) of the input pulses

(vii) Connection diagram

Note: For devices which are part of an approved meter, these requirements may be satisfied through physical marking or via the meter’s approved electronic display. For stand-alone devices, these requirements shall be satisfied through physical marking.

5.12.2 Clause 12-2.1 is amended as follows:

12-2.1 Detent. Pulse initiators shall only be capable of generating pulses that are representative of the indicated direction of energy flow.
5.13 Amendments to section 13 – Programmable devices and pulse recorders of LMB-EG-07

5.13.1 Section 13 of LMB-EG-07 is replaced as follows:

13 Requirements for auxiliary data recorders used to receive legally relevant data

13-1 This clause is deleted.

Clauses 13-2 and 13-3 are replaced as follows:

13-2 Data recorders are subject to the general requirements of section 3 of LMB-EG-07 as applicable.

13-3 Data recorders capable of storing billing data or programming information are subject to the requirement of clause 3-2.8.5 of LMB-EG-07.

13-4.1 Marking requirements for auxiliary data recorders. In addition to the requirements of subsection 3-4.1 of LMB-EG-07, every data recorder shall bear, as appropriate, the following information:

(i) Time stamp interval period (if applicable)

(ii) For each channel, input identification, data multiplier or pre-scalar unit

(iii) Rated voltage and frequency of auxiliary power supply

(iv) Rated or maximum voltage and type of input

(v) Connection diagram

Note: If a device simply receives data, temporarily stores them, and then retransmits them, or a fraction or multiple thereof, then the data multiplier need not be marked on the nameplate since the data could come from any source and be sent to any other receiving device.

13-4.2 Marking requirements for meters containing a data recording component.

In addition to the requirements of subsection 3-4.1 of LMB-EG-07, every source meter shall bear, as appropriate, the following information for each data recording register:

(i) Time stamp interval period (if applicable)\[d\]

\[d\] These requirements may be satisfied through physical marking or via the meter’s approved electronic display.
(ii) Data type
d
(iii) Data multiplier or pre-scalar unit (if applicable)
d
13-5 Performance requirements for data recorders

13-5.1 Data recorders shall not gain or lose more than 0.05% of the true value of received data when operated for a period of one hour at any rate of data flow and while varying supply voltage between 90%, 100% and 110% of rated voltage.

13-5.2 Data recorders shall not gain or lose more than 0.05% of the true value of received data when operated for a period of one hour at any rate of data flow and over a temperature range from -40°C to +53°C or at the temperature extremes specified on the nameplate, whichever is less.

13-5.3 Data recorders shall not record any data when operated for a period of one hour with no input data flow and at rated supply voltage.

13-5.4 Time stamped interval length shall be comprised of 5-minute intervals. The time stamped interval length shall not deviate from the specified interval length by more than 0.1% (0.33 seconds on a 5-minute interval).

13-5.5 Data recorders shall provide means to indicate the direction of the energy flow that is represented by the delivered data.

13-5.6 Data recorders shall be capable of recording data to the same resolution at which the data was received.

5.14 Amendments to section 14 – Instrument transformers of LMB-EG-07

This section was revoked July 1, 2008, and replaced with S-E-07—Specifications for the Approval of Measuring Instrument Transformers.

5.15 Amendments to section 15 – Static demand meters of LMB-EG-07

5.15.1 Subsection 15-2 is amended to include technical requirements to evaluate the maximum demand reset mechanism of static demand meters as follows:

15-2.1 General. The requirements of subsection 3-2 shall apply.
15-2.2 Reset device. A mechanical reset device shall be such that, in its normal position, it does not affect the values stored in maximum demand registers and/or displayed by them. Means shall be provided for sealing the reset device in this position. Resetting of any maximum demand register shall only be possible either after breaking the seal or with a special tool.

15-2.3 Maximum demand source legal unit of measure registers. The meter shall record and store the maximum demand reading at the time of the most recent maximum demand reset. The meter shall be capable of displaying this reading either on demand, via a regular scroll sequence or continuously.

5.15.2 Subsection 15-3.1, “Test Links”, was revoked. Advances in technology have made it possible to facilitate the safe, effective and accurate testing of electricity meters without the use of test links. Electricity meters submitted to Measurement Canada for approval of type pursuant to specification LMB-EG-07 are not required to make use of test links.

5.15.3 Subsection 15-3.2 is revised as follows.

15-3.2 Demand interval

15-3.2.1 Demand interval lengths shall be either sliding window or block with a duration of 15, 20, 30 or 60 minutes.

15-3.2.2 Sliding window responding meters shall be comprised of consecutive 5-minute subintervals.

15-3.2.3 The time stamped interval length shall not deviate from the specified interval length over the period of three intervals by more than 0.1% (0.9 seconds on 3 x 5-minute subintervals).

15-3.2.4 Demand interval indicator. Meters shall be equipped with a means for indicating the start or end of each demand block interval or subinterval as applicable. The subinterval indicator can be a pulse output or other form of discrete indication such as a display annunciator, relay output or light output and will be used to assess the accuracy of the demand intervals and subintervals.

5.15.4 Subsection 15-3 is amended to include technical requirements to evaluate electronic means of maximum demand reset as follows:

15-3.4 Reset device

15-3.4.1 A meter that is equipped with a register for maximum demand values of any LUM and is not equipped with a mechanical reset mechanism shall have electronic means by which the maximum demand register may be reset.

15-3.4.2 Resetting shall be performed through an on-board device or a remote mechanism. Actuation of the reset means shall have the effect of resetting demand values stored in any maximum demand register to zero, or to the current demand value.

5.15.5 Subsection 15.4 is amended as follows:
15-4 Markings

15-4.1 Nameplates for single-customer meters – General

15-4.1.1 In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter may be placed elsewhere on the meter on condition that this same information also appears either inside or outside of the cover of an enclosure which shall be submitted as part of the approval of type application.

15-4.1.2 Meters approved with nameplate information not legible from the front of the meter shall be approved for installation only on the load side of the main switch or circuit breaker of the service for which the meter is installed. This installation restriction will be contained in the Notice of Approval.

15-4.1.3 If the meter is provided with accessories such as retransmitting contacts, this shall be specified on the nameplate and a diagram of connections shall be provided if considered necessary by the Director.

15-4.2 Nameplates for single-customer meters – Information requirements

15-4.2.1 In addition to the requirements of subsection 3-4, every meter used for single-point metering shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly legible from the front, with all covers in place.

(i) Rated frequency

(ii) Rated voltage or voltages

Note: For 2½-element wye and 3-element meters, the rated voltage is phase to neutral voltage.

(iii) Minimum and maximum rated currents

(iv) Demand interval length (if block) and subinterval length if sliding window

(v) Single-phase test constant (if applicable)

(vi) Meter configuration notations. The following examples are recommended:

- 1-phase, 2-wire
- 1-phase, 3-wire
- 1-phase, 3-wire, 2-element
- 2-element, network
- 2-element, delta
- 2½ (or 2.5)-element wye or delta
- 3-element wye
(vii) All information required to determine the demand from the meter indication

(viii) For primary rated meters,

(a) Current transformer rating (e.g., 100-5 A)
(b) Voltage transformer rating (e.g., 600-120 V)

(ix) For single-phase transformer-type meters, the words “transformer type”

(x) For meters that are internally compensated for line or transformer losses, the words “Loss compensated” shall be indelibly marked on the nameplate.

(xi) Firmware versions

15-4.3 Nameplates for multiple customer metering systems – General

15-4.3.1 In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter shall be placed elsewhere on the meter on condition that this same information also appears either inside or outside of the cover of an enclosure which shall be submitted as part of the approval of type application.

15-4.3.2 Where the configuration information is not available on the nameplate or approved electronic display, the MCMS unit shall have a secondary nameplate, configuration chart or supporting documentation which provides the specific configuration information of each meter as programmed in the MCMS. The information shall be clearly identified as supporting documentation for the configuration of the device. The provision of configuration information may be satisfied through the use of an alternate electronic display such as a laptop or a PC connected to the MCMS.

15-4.3.3 If an MCMS has more than one configuration, all approved configurations specific to that model shall be on the nameplate. If an MCMS has the same configuration for each meter, the applicable configuration can be the only one to appear on the nameplate.

15-4.3.4 In the case where the size or the design of the meter limits the amount of information that can be put on the front of the meter, the information not appearing on the front of the meter may be placed on the terminal cover on condition that this same information also appears elsewhere on the meter itself. In such a case, as a minimum, the serial number affixed on the meter itself shall be visible when the meter is installed.

15-4.3.5 Meters approved with nameplate information not legible from the front of the meter shall be approved for installation only on the load side of the main switch or circuit breaker of the service for which the meter is installed. This installation restriction will be contained in the Notice of Approval.
15-4.3.6 If the meter is provided with accessories such as retransmitting contacts, this shall be specified on the nameplate and a diagram of connections shall be provided if considered necessary by the Director.

15-4.4 Nameplates for multiple customer metering systems – Information requirements

15-4.4.1 In addition to the requirements of subsection 3-4, every MCMS shall have the following details indelibly and distinctly marked on one or more nameplates attached in such a way as to be clearly legible from the front, with all covers in place.
(i) Rated frequency*

(ii) Rated voltage or voltages

   **Note:** For 2½-element wye and 3-element meters, rated voltage is phase to neutral voltage.

(iii) Minimum and maximum rated currents

(iv) Demand interval length if block and subinterval length if sliding window*

(v) Single-phase test constant (if applicable)*

(vi) The actual configuration of each meter, as programmed in the MCMS. The following examples are recommended*:
   
   1-phase, 2-wire  
   1-phase, 3-wire, 2-element  
   2-element, network  
   2-element, delta  
   3-element, wye

   **Note:** Accepted symbols are Ø, EL, Y and Δ.

(vii) All information required to determine the demand from the meter indication*

(viii) For primary rated meters,

   (a) Current transformer rating (e.g., 200-100 mA)*
   
   (b) Voltage transformer rating (e.g., 600-120 V)*

(ix) For single-phase transformer-type meters, the words "transformer type"

(x) For meters which are internally compensated for line or transformer losses, the words "Loss compensated" shall be indelibly marked on the nameplate.

* These requirements may be satisfied through physical marking or via the meter's approved electronic display.
(xi) Firmware versions*

5.15.6 The first sentence of subsection 15-5 is amended as follows:

The performance requirements of subsection 15-5 pertain to measured values for each demand LUM to be approved and which is provided by the meter via a means of indication and any data output.

5.15.7 Subsection 15-5 is amended to include technical requirements to evaluate standardized demand legal units of measure as follows:

15-5.12 All demand quantities shall be established on the basis of energy registration measured over an integration period specified in clause 15.3.2 above.

15-5.13 All demand quantities shall be established from corresponding energy values which are established in accordance with the requirements of section 6 of this specification.

15-5.14 Meters shall acquire any consumption data used in establishing the demand registration either continuously or at a rate of at least once per minute.

15-5.15 Volt-ampere demand meters which are not approved for the volt-ampere hour function shall provide a volt-ampere hour test pulse or other similar means to facilitate assessment.

15-5.16 Polyphase volt-ampere demand meters which are not assessed for volt-ampere hour energy measurement shall be assessed for performance under unbalanced polyphase loads. The applied test current shall be such that each phase is subject to a value different than the other one or two (as applicable) phases. Similarly, the power factor for each phase shall be set to a value different from the other one or two (as applicable) phases. Errors shall not exceed +/-0.75% while any current value from minimum to maximum is applied and at any power factor between 0.5 lead and 0.5 lag.

15-5.17 Allocation of active demand (W) by direction

15-5.17.1 Watt demand which is derived from the integration over time of active energy recorded in a register identified as Wh (del) may be allocated into a register identified as W (del).

15-5.17.2 Watt demand which is derived from the integration over time of active energy recorded in a register identified as Wh (rec) may be allocated into a register identified as W (rec).

15-5.17.3 No active demand values pursuant to 15-5.17.1 shall be recorded in a W (rec) register and no active demand pursuant to 15-5.17.2 shall be recorded in a W (del) register.

15-5.18 Allocation of apparent demand (VA) by direction
15-5.18.1 VA demand which is derived from the integration over time of apparent energy recorded in a register identified as VAhr (del) may be allocated into a register identified as VA (del).

15-5.18.2 VA demand which is derived from the integration over time of apparent energy recorded in a register identified as VAhr (rec) may be allocated into a register identified as VA (rec).

15-5.18.3 No apparent demand values pursuant to 15-5.18.1 shall be recorded in a VA (rec) register and no apparent demand pursuant to 15-5.18.2 shall be recorded in a VA (del) register.

15-6 Demand meter performance under harmonic influence

15-6.1 Demand meters shall maintain performance to specified tolerances consistent with the corresponding energy quantity when subjected to the harmonic influences.

15-6.2 Demand values are derived from corresponding energy values. Harmonic content requirements are established in section 6 of this specification. Demand performance shall be established on the basis of a combination of functionality testing and written attestations of compliance.

5.16 Amendments to section 16 – Induction type voltage-squared hour meters of LMB-EG-07

5.16.1 Subsection 16.4 is amended as follows:

16-4 Markings

16-4.1 Nameplates. In addition to the applicable requirements of subsection 4-4, the nameplate shall bear the following information:

(i) For secondary rated meters, the single phase test constant and the pulse constant Kp in V²h per pulse

(ii) For primary rated meters:

(a) Voltage transformer ratio

(b) Pulse constant Kp in V²h per pulse

5.17 Amendments to section 17 – Static voltage-squared hour meters of LMB-EG-07

5.17.1 Subsection 17.4 is amended as follows:

17-4 Markings
17.4.1 Nameplates. In addition to the requirements of subsection 16-4, the nameplate shall bear the following information:

(i) Firmware versions (prominently indicated either on the meter nameplate or via the electronic display).

5.17.2 Subsections 17-5.8 and 17-5.9 are added as follows:

17-5.8 Static voltage-squared hour meter performance under harmonic influence – General

17-5.8.1 Static voltage-squared hour meters ($V^2$ h) shall register energy only on the basis of voltage at the fundamental frequency. Registration shall be within specified tolerances for non-sinusoidal load conditions containing voltage harmonic content as defined in the clauses of 17-5.8.2 below.

17-5.8.2 $V^2$ hour energy meter registration shall not exceed specified tolerances under the influence of harmonic conditions simulated by the following non-sinusoidal waveforms:

(a) Quadriform waveform
(b) Peaked waveform
(c) Pulsed waveform
(d) Severe voltage waveform
(e) Even harmonic waveform

Unless otherwise noted, harmonic test waveforms shall be generated at amplitudes having an error not greater than 1% of the fundamental or 25% of the test harmonic amplitude.

17-5.8.3 Test waveforms are defined by the general equations established in clause 6-10.2.2.

17-5.8.4 Waveforms comprising harmonics having a phase and amplitude as indicated in the tables established in clauses 9-4.11.5 to 9-4.11.11 shall be applied to the voltage and current circuits of the meter.

17-5.9 Static voltage-squared hour meter performance under harmonic influence – Limits of error

17-5.9.1 For any test condition indicated in the tables established in clauses 9-4.11.5 to 9-4.11.9 the meter registration shall not exceed +/-0.6% error.
17-5.9.2 For any test condition indicated in the tables established in clauses 9-4.11.10 or 9-4.11.11 the meter registration shall not exceed +/-0.5% error.

5.18 Amendments to section 18 – Sub-metering of LMB-EG-07

Reserved for future amendments to section 18 of LMB-EG-07.

5.19 Amendments to section 19 – Signal converters of LMB-EG-07

Reserved for future amendments to section 19 of LMB-EG-07.

6.0 New sections of LMB-EG-07

6.1 Section 20 – Additional requirements for meters that provide interval data approved for use in the derivation of processed legal unit of measure values

20-1 Performance requirements

20-1.1 Interval data provided by a meter which is to be approved for use in establishing energy LUMs shall be subject to the performance requirements established in subsections 6-4.3 to 6-4.14 of LMB-EG-07.

20-1.2 Interval data provided by a meter which is to be approved for use in establishing demand LUMs shall be subject to the performance requirements established in subsection 15-5 of LMB-EG-07.

20-1.3 Demand interval length shall comply with the requirements established in subsection 15-3.2.

20-1.4 The performance requirements shall apply throughout the entire accumulation of the interval data.

6.2 Section 21 – Additional requirements for auxiliary conversion devices and conversion functions

21-1 General requirements

Requirements which apply to data recorders as established in subsection 5.13.1 shall apply, where applicable, to auxiliary conversion devices.

21-2 Marking requirements
Marking requirements as indicated in subsections 12-4, 13-3, 15-4 and 21-2 of LMB-EG-07 shall apply to auxiliary conversion devices and to meters which have conversion functions as applicable.

21-3 Performance requirements

21-3.1 The magnitude of any LUM value indicated by a conversion device or function shall not differ from the computational value derived from measured or input values of LUMs or LR data by more than 0.01%.

21-3.2 Demand interval length shall comply with the requirements established in subsection 15-3.2.

21-3.3 The basic operating constants (such as Kp, Kh and demand interval length) used in calculating LUM values shall be stored within the device in such a manner that they cannot be changed without breaking a meter seal.

21-3.4 Under reference conditions established in subsection 3-5.1 of LMB-EG-07 and with no input applied, the conversion device/function shall produce zero registration. The duration of the test shall be determined based on a hypothetical load of 0.05% of $I_{\text{max}}$ at the test voltage and the test condition described in (a) to (c) as applicable:

(a) Demand test: The duration of the test shall be at least one complete demand interval provided that the demand register has sufficient resolution to indicate a non-zero value at the hypothetical applied load.

(b) Pulse output or disk revolution simulator: The minimum duration of the test shall be the amount of time that would be required to obtain one pulse or disk revolution at the hypothetical applied load.

(c) Energy register test: The minimum duration of the test shall be the amount of time that would be required to register a non-zero value at the hypothetical applied load.

21-3.5 Conversion devices and functions shall provide LUM values and LR data to the same resolution at which the data was received. Indication of LUM values, (where provided), shall be to a minimum resolution of three digits to the right of the decimal place.

21-3.6 The requirements established in clause 15-5.6 of LMB-EG-07 shall apply.

21-3.7 The conversion device shall comply with all accuracy requirements when supply voltage is 10% below and 10% above the rated supply voltage. In addition, the indicated LUM values and LR data shall not differ by more than 0.2% from that established at rated supply voltage.

21-3.8 The requirements established in clause 15-5.7 of LMB-EG-07 shall apply.
6.3 **Section 22 – Administrative requirements**

**22-1 Notice of Approval**

The Notice of Approval shall indicate whether a device has been assessed and approved in accordance with the provisions of PS-E-18.

**Note:** If a device has been assessed and approved in accordance with the provisions of S-E-06, this may be indicated in the Notice of Approval; however, it is not required.