**AMENDMENT NO. 2 SEPTEMBER 2024**

**TO**

**IS 14697: 2021 a.c. STATIC TRANSFORMER OPERATED WATTHOUR METERS (CLASS 0.2 S AND**

**0.5 S) AND VAR-HOUR METERS (CLASS 0.2 S, 0.5 S AND 1 S) – SPECIFICATION**

*(First Revision)*

(*First cover page*, *Hindi Title*) — Insert 0.1 एस in the main Hindi title, as below:

ए. सी. स्टैटिक ट्रांसफार्मर ऑपरेटेड वॉटआवर मीटर (वर्ग 0.1 एस, 0.2 एस एवम 0.5 एस) एवम वारआवर मीटर (वर्ग 0.1 एस, 0.2 एस, 0.5 एस एवम 1 एस)

(*First cover page*, *English Title*) — Insert the 0.1 S in the main English title, as below:

a.c. Static Transformer Operated Watthour Meters (Class 0.1 S, 0.2 S and 0.5 S) and Var-Hour Meters (Class 0.1 S, 0.2 S, 0.5 S and 1 S)

(*Foreword, para 4*) — Substitute the following for the existing para:

The best possible accuracy is achieved by the class 0.1 S but electronic techniques available also allow smaller errors and deviations under influence quantities for class 0.2 S, 0.5 S and 1 S meters than which are permitted for induction meters of same accuracy classes.

(*Foreword, para 5, line 1*) — Substitute the following for the existing line:

This standard specifies the general requirements and tests applicable to transformer operated static watthour meters of 0.1 S, 0.2 S and 0.5 S and var-hour meters of class 0.1 S, 0.2 S, 0.5 S and 1 S keeping in view performance levels attainable in such meters.

(*Page 1, Title*) — Substitute the following for the existing:

a.c. Static Transformer Operated Watthour Meters (Class 0.1 S, 0.2 S and 0.5 S) and Var-Hour Meters (Class 0.1 S, 0.2 S, 0.5 S and 1 S)

(*Page 1, clause* **1.1**) — Substitute the following for the existing clause:

This standard specifies static watthour meters of accuracy class 0.1 S, 0.2 S, 0.5 S and var-hour meters of accuracy class 0.1 S, 0.2 S, 0.5 S and 1 S for the measurement of alternating current electrical active and reactive energy of frequency in the range of 45 Hz to 55 Hz for single phase and three phase balanced and unbalanced loads. It applies to their type tests, routine tests and acceptance tests.

(*Page 4*) — Insert the following after clause 3.5.7:

**3.5.8 Uncertainty of Measurement**

Parameter, associated with the result of a measurement, that characterizes the relative dispersion of the values, expressed as a percentage, that could reasonably be attributed to the measurand

Note 1: The parameter can be, for example, a standard deviation (or a given multiple of it), or a half width of an interval having a stated level of confidence. Various ways of obtaining uncertainty are defined in the IEC Guide 98-3 (GUM:1995 / JCGM 100: 2008).

Note 2: Uncertainty of measurement comprises, in general, many components. Some of these components can be evaluated from the statistical distribution of the results of a series of measurements and can be characterized by experimental standard deviations. The other components, which can also be characterized by standard deviations, are evaluated from the assumed probability distributions based on experience or other information.

(*Page 5, clause* **4**) — Substitute the following for the existing line:

Meters are classified according to their respective class indices, for example, 0.1 S, 0.2 S or 0.5 S (active energy) and 0.1 S, 0.2 S, 0.5 S or 1 S (reactive energy).

(*Page 6, clause* **6.4***, para 3*) — Substitute ‘124°C’ *for* ‘135°C.

(*Page 9, Table 7, col 2, Title*) — Substitute ‘**Class of Meters (0.1 S, 0.2 S, 0.5 S and 1 S)**’ *for* ‘**Class of Meters (0.2 S, 0.5 S and 1 S)**.

(*Page 9, Table 9*) — Substitute the following table for the existing:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table 9 Variations Due to Short-time**  **Over Currents**  (*Clause* 9.2.3) | | | | | |
| **Value of Current** | **Power Factor** | **Limits of Variation in Percentage of Error for Meters of Class** | | | |
|  |  | 0.1 S | 0.2 S | 0.5 S | 1 S |
| (1) | (2) | (3) | (4) | (5) | (6) |
| Ib | 1 | 0.10 | 0.10 | 0.10 | 0.10 |

(*Page 10, Table 10*) — Substitute the following table for the existing:

**Table 10 Variation in Percentage Error Due to Self-Heating**

(*Clause* 9.3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value of Current** | **Power Factor** | **Limits of Variation in Percentage Error for Meter of Class** | | | |
| (1) | (2) | **0.1 S**  (3) | **0.2 S**  (4) | **0.5 S**  (5) | **1 S**  (6) |
| Imax | 1 | 0.05 | 0.10 | 0.20 | 0.50 |
| Imax | 0.5 lagging | 0.07 | 0.10 | 0.20 | 0.70 |

(*Page 10, Table 10A*) — Substitute the following table for the existing:

**Table 10A Change of Error Due to Earth/Phase Fault**

(*Clause 9.6*)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value of Current** | **Power Factor** | **Limits of Variation in Percentage Error for Meter of Class** | | | |
| (1) | (2) | **0.1 S**  (3) | **0.2 S**  (4) | **0.5 S**  (5) | **1 S**  (6) |
| Ib | 1 | 0.10 | 0.20 | 0.40 | 0.70 |

(*Page 11, Table 11A*) — Substitute the following table for the existing:

**Table 11A Percentage Error Limits (Single-Phase Meters and Polyphase Meters with Balanced Loads)**

(*Clause* 11.1)

**SI No. Value of Current Power Factor**

**Percentage Error Limits for Meter of Class**

**0.1 S 0.2 S 0.5 S**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (1) | (2) | (3) | (4) | (5) | (6) |
| (i) | 0.01 Ib ≤ I < 0.05 Ib | 1 | ± 0.20 | ± 0.40 | ± 1.00 |
| (ii) | 0.05 Ib ≤ I ≤ Imax | 1 | ± 0.10 | ± 0.20 | ± 0.50 |
| (iii) | 0.02 Ib ≤ I < 0.1 Ib | 0.5 lagging | ± 0.25 | ± 0.50 | ± 1.00 |
| (iv) | 0.8 leading | ± 0.25 | ± 0.50 | ± 1.00 |
| (v) | 0.1 Ib ≤ I ≤ Imax | 0.5 lagging | ± 0.15 | ± 0.30 | ± 0.60 |
| (vi) | 0.8 leading | ± 0.15 | ± 0.30 | ± 0.60 |
| (vii) | When specially required by the user: from 0.2 Ib to Ib | 0.25 lagging | ± 0.25 | ± 0.50 | ± 1.00 |
| (viii) | 0.5 leading | ± 0.25 | ± 0.50 | ± 1.00 |

(*Page 11, Table 12*) — Substitute the following table for the existing:

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**Table 12 Percentage Error Limits (Polyphase Meters Carrying a Single-Phase Load but with**

**Balanced Polyphase Voltages Applied to Voltage Circuits)**

(*Clause* 11.1)

**Sl No. Value of Current Power Factor of Relevant Element Percentage Error Limits for Meters of Class**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (1) | (2) | (3) | **0.1S 0.2 S**  (4) (5) | **0.5 S**  (6) | **1 S**  (7) |
| i) | 0.05 Ib ≤ I ≤ Imax | 1 | ± 0.15 ± 0.30 | ± 0.60 | ± 1.5 |
| ii) | 0.1 Ib ≤ I ≤ Imax | 0.5 lagging | ± 0.20 ± 0.40 | ± 1.00 | ± 2.0 |

(*Page 11, clause* **11.1***, para 3*) — Substitute the following for the existing:

The difference between the percentage error when the meter is carrying a single-phase load at basic current and unity power factor and the percentage error when the meter is carrying balanced polyphase load at basic current and unity power factor, shall not exceed 0.20 percent, 0.40 percent, 0.80 percent and 1.5 percent for meters of classes 0.1 S, 0.2 S, 0.5 S and 1 S respectively.

(*Page 12, Table 13*) — Substitute the following table for the existing:

**Table 13 Influence Quantities**

*(Clauses 9.2.1,11.2, 12.8.3, 12.8.4 and 12.10)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SI No.** | **Influence Quantities** | **Value for current (Balanced Unless Otherwise Stated)** | **Power Factor** | **Limit of Variation in Percentage Error for Meters of Class** | | | |
|  |  |  |  | **0.1 S** | **0.2 S** | **0.5 S** | **1 S** |
| **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** |
| i) | Voltage Variation (*see Note 1*)  ±10 percent | 0.05 Ib ≤ I ≤ IMax | 1 | 0.05 | 0.10 | 0.20 | 0.40 |
| ii) | 0.1 Ib ≤ I ≤ IMax | 0.5 lagging | 0.10 | 0.20 | 0.40 | 0.80 |
| iii) |  | 0.05 Ib ≤ I ≤ IMax | 1 | 0.05 | 0.10 | 0.20 | 0.40 |
| iv) | Frequency Variation ±5 percent | 0.1 Ib ≤ I ≤ IMax | 0.5 lagging | 0.05 | 0.10 | 0.20 | 0.40 |
| v) | Waveform 10% of 3rd harmonic in the current (*see Note 2*) | 0.05 Ib ≤ I ≤ IMax | 1 | 0.05 | 0.10 | 0.10 | 0.20 |
| vi) | Reversed phase sequence | 0.1 Ib | 1 | 0.05 | 0.05 | 0.10 | 0.20 |
| vii) | Voltage Unbalance (*see Note 3*) | Ib | 1 | 0.25 | 0.50 | 1.0 | 2.0 |
| viii) | Auxiliary voltage ± 15 percent  (*see Note 4*) | 0.05 Ib | 1 | 0.05 | 0.05 | 0.10 | 0.20 |
| ix) | Phase of Auxiliary supply voltage  by 120 degree (s*ee Note 4*) | 0.05 Ib | 1 | 0.10 | 0.10 | 0.20 | 0.40 |
| x) | Continuous magnetic induction of  external origin (*see Note 5)* | Ib | 1 | 2.0 | 2.0 | 3.0 | 3.0 |
| xi) | Magnetic induction of external  origin 0.5mT (*see Note 6)* | Ib | 1 | 0.50 | 0.50 | 1.0 | 2.0 |
| xii) | Electromagnetic HF fields  (*see Note 7*) | Ib | 1 | 0.50 | 1.0 | 2.0 | 2.0 |
| xiii) | Continuous abnormal magnetic induction of external origin  *(see Note 9)* | Ib | 1 | 4.0 | 4.0 | 4.0 | 4.0 |
| xiv)  xv) | Abnormal ac magnetic induction of external origin (10mT)  (*see Note 9)*  Fast Transient Burst (see Note 10) | Ib  Ib | 1  1 | 4.0  1.0 | 4.0  2.0 | 4.0  3.0 | 4.0  4.0 |
|  |  |  |  |  |  |  |  |

*(Page 13, Table 14)* — Substitute the following table for the existing:

**Table 14 Temperature Co-efficient**

*(Clause 11.3)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **I**  **No.** | **Value of Current** | **Power Factor** | **Mean Temperature Coefficient for Meter of Class (percentage /°C)** | | | |
|  |  |  | **0.1 S** | **0.2 S** | **0.5 S** | **1 S** |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| i) | From 0.05 Ib to IMax | 1 | 0.005 | 0.010 | 0.030 | 0.050 |
| ii) | From 0.1 Ib to IMax | 0.5 lagging | 0.010 | 0.020 | 0.050 | 0.070 |

(*Page 13, c*lause **11.6**, *para 1, last line*) — Substitute the following for the existing line:

The allowed error in meter constant shall not be more than 0.02 percent for class 0.1 S, 0.04 percent for class 0.2 S, 0.1 percent for class 0.5 S meter and

0.20 percent for class 1 meter.

(*Page 13,* Table 15) — Substitute the following table for the existing:

**Table 15 Starting Currents**

*(Clause 11.5)*

|  |  |  |
| --- | --- | --- |
| **Value of Current**  (1) | **Power Factor**  (2) | **Class of Meter**  **0.1 S 0.2 S 0.5 S 1 S**  (3) (4) (5) (6) |
| Percentage of Ib | 1 | 0.10 0.10 0.10 0.20 |

(*Page 13, c*lause **11.7**) — Substitute the following for the existing line:

Repeatability of error at 5 percent Ib, Ib and UPF load shall not exceed 0.05 for class 0.1 S, 0.10 for class 0.2 S, 0.25 for class 0.5 S and 0.50 for class 1 S meters as measured by the dispersion method (*see* **12.16**).

(*Page 20,* Table 19) — Substitute the following table for the existing:

**Table 19 Voltage and Current Balance**

*(Clause 12.9.1)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Polyphase Meters** |  | **Class of Meters** | |  |
|  |  | **0.1 S** | **0.2 S** | **0.5 S** | **1 S** |
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | Each of the voltages between line and neutral or between any two lines shall not differ from the average corresponding  voltage by more than | ±1 percent | ±1 percent | ±1 percent | ±1 percent |
| ii) | Each of the currents in the current circuit shall not differ from the average current by more than | ±1 percent | ±1 percent | ±1 percent | ±2 percent |
| iii) | The phase displacements of these currents from the corresponding line- to-neutral voltage, irrespective of the power factor, shall not differ from each other by more than | 2 degree | 2 degree | 2 degree | 2 degree |

*(Page 20, Table 20, col 4, Title)* — Substitute ‘**Permissible Tolerance 0.1 S, 0.2 S, 0.5 S, 1 S**’ *for* ‘**Permissible Tolerance 0.2 S, 0.5 S, 1 S**’.

(*Page 21, clause* **12.12**, *para 3*) — Substitute the following for the existing formula for minimum test period Δt:

### ∆ *t =* (900 × 106 )/(*k m Un Imax*) [min] ± 1 min for meters of class 0.1 S and 0.2 S,

(*Page 21,* Table 21) — Substitute the following table for the existing:

**Table 21 Interpretation of Test Results**

*(Clauses 11.1 and 12.15)*

|  |  |
| --- | --- |
| (1) | **Class of Meter**  **0.1 S 0.2 S 0.5 S 1 S**  (2) (3) (4) (5) |
| Permissible displacement of the zero line, percent | 0.05 0.10 0.20 0.50 |

(*Page 31, Annex G*) — Insert the following after G-20:

**G-21 MEASUREMENT UNCERTAINTY**

An expanded uncertainty (U) shall be estimated according to IEC Guide 98-3 (GUM:1995/ JCGM 100:2008) with a level of confidence of approximately 95 %.

An expanded uncertainty U shall not be greater than 1/5th of the error limit for the relevant accuracy class, for all accuracy classes except class 0.1 S, unless otherwise specified in the relevant test description.

For the accuracy class 0.1 S, an expanded uncertainty U shall not be greater than 1/3rd of the error limit, unless otherwise specified in the relevant test description.

If these requirements are met, the test results may be evaluated by comparing the measured percentage error values with the percentage error limit.

NOTE This decision rule is known as simple acceptance or shared risk (ISO/IEC Guide 98-4:2012 (JCGM 106), 8.2). The probability of a false acceptance or false rejection is not always negligible, but the chances of incorrect decisions are kept to an acceptable level.

However, if the above-mentioned expanded uncertainty requirements cannot be met, the test results (the measured percentage error values) may be evaluated against the percentage error limits reduced by the obtained value of expanded uncertainty U. In this case, the following acceptance criteria shall be used:

For accuracy class 0.1 S:

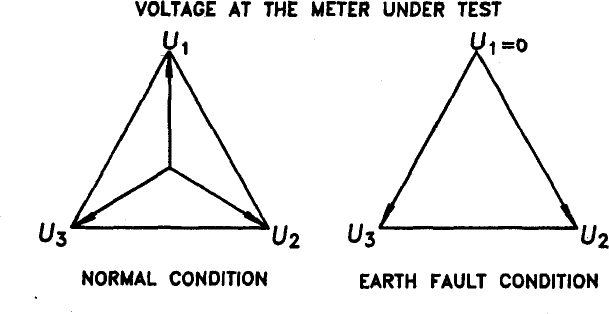
𝜀reduced = ± (4/3 × |𝜀| − |𝑈|)

where

𝜀reduced is the reduced percentage error limit;

𝜀 is the percentage error limit specified in the relevant accuracy class standard for the corresponding test; U is the obtained value of expanded uncertainty.

EXAMPLE When assuming that during testing for type evaluation of a class 0.1 S meter, the test result has an expanded uncertainty U = 0.03 % (k = 2), the test result can be accepted if the percentage error is between ± (4/3 × 0.1 – 0.03) % = ± 0.1 %.

(*Page 34,* Annex J) – Substitute the following phasor diagram for the existing: