**AMENDMENT NO. 2 DECEMBER 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*, *Hindi title*) — Substitute the following for the existing:

‘**ए. सी. स्टैटिक ट्रांसफार्मर ऑपरेटेड वॉटआवर मीटर (वर्ग 0.1 एस, 0.2 एस एवं 0.5 एस) एवं वारआवर मीटर (वर्ग 0.1 एस, 0.2 एस, 0.5 एस एवं 1 एस)**’.

(*First cover page*, *English title*) — Substitute the following for the existing:

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

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

‘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 metres than which are permitted for induction meters of same accuracy classes.’

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

‘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:

‘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, *clause* **3.5.7**) — Insert the following at the end:

‘**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.

NOTES

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).
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:

‘Metres 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 Metres (0.1 S, 0.2 S, 0.5 S and 1 S)**’ *for* ‘**Class of Metres (0.2 S, 0.5 S and 1 S)**’.

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

**Table 9 Variations Due to Short-time Over Currents**

(*Clause* 9.2.3)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Value of Current** | **Power Factor** | **Limits of Variation in Percentage Error for Metre of Class** | | | |
| (1) | (2) | (3) | 0.1 S  (4) | 0.2 S  (5) | 0.5 S  (6) | 1 S  (7) |
|  | 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* 10) — Substitute the following for the existing:

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

(*Clause* 9.3)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Value of Current** | **Power Factor** | **Limits of Variation in Percentage Error for Meter of Class** | | | |
| (1) | (2) | (3) | 0.1 S  (4) | 0.2 S  (5) | 0.5 S  (6) | 1 S  (7) |
|  | 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 for the existing:

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

(*Clause* 9.6)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Value of Current** | **Power Factor** | **Limits of Variation in Percentage Error for Meter of Class** | | | |
| (1) | (2) | (3) | 0.1 S  (4) | 0.2 S  (5) | 0.5 S  (6) | 1 S  (7) |
| i) | Ib | 1 | 0.10 | 0.20 | 0.40 | 0.70 |

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

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

(*Clause* 11.1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl 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 for the existing:

**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 for the existing:

**Table 13 Influence Quantities**

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

| **Sl 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 percent 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 0.5 mT (*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 a.c. magnetic induction of external origin (10 mT) (*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 |

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

**Table 15 Starting Currents**

(*Clause* 11.5)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Value of Current** | **Power Factor** | **Class of Meter** | | | |
| 0.1 S | 0.2 S | 0.5 S | 1S |
|  | (2) | (3) | (4) | (5) | (6) | (7) |
|  | | | |
| i) | Percentage of Ib | 1 | 0.10 0.10 0.10 0.20 | | | |

(*Page* 13, *clause* **11.7**) — Substitute the following for the existing:

‘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 metres as measured by the dispersion method (*see* **12.16**).’

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

∆ *t =* (900 × 106)/(*k m Un Imax*) [min] ± 1 min for metres of class 0.1 S and 0.2 S’.

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

**Table 21 Interpretation of Test Results**

(*Clauses* 11.1 *and* 12.15)

|  |  |  |
| --- | --- | --- |
| **Sl No.**  (1) | (2) | **Class of Meter**  0.1 S 0.2 S 0.5 S 1 S  (3) (4) (5) (6) |
| i) | Permissible displacement of the zero line, percent | 0.05 0.10 0.20 0.50 |

(*Page* 31, *clause* **G-20**) — Insert the following at the end:

‘**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 percent.

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

*Example:*

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

(*Page* 34, *Annex J*) — Substitute the following for the existing:

