

SCHEDULE 1

Regulations 3(2)(c) and 4(2)(d)

**Authorised Manufacturers' and authorised repairers' tests
and testing methods for alternating current watt-hour meters**

Pre-heating

1.—(1) The following tests shall not be carried out until the voltage circuits of meters under test and the voltage circuit of working standard integrating meters have been energised for a period of one hour or half an hour if a current of not less than either 10% of basic current or 5% of marked current is applied to the current circuit of the meters, save that the non-registration and starting current tests may be carried out during the pre-heating period.

(2) Sub-paragraph (1) shall not apply to a meter which the examiner is satisfied is capable of full operation as soon as it is energised.

Non-registration test

2. Induction meters

(1) Induction meters shall be tested to ensure that when the current circuits are open and a voltage of 110% of the declared system voltage is applied to the voltage circuits, rotors cease to rotate before completing one complete revolution.

Static meters

(2) Static meters shall be tested for non-registration by one of the following methods—

Method 1

(a) (i) When subjected to the test conditions specified in paragraph 2(1), the meter shall not emit more than one output pulse over the minimum test period determined in paragraph (ii);

(ii) the minimum test period (t) shall be computed by the formula:

$$t \geq 480 \times 106 k.m.V.Im \text{ minutes}$$

where:

k = number of pulses per kWh emitted by the meter

m = number of elements

V = declared system voltage

Im = marked maximum current.

Method 2

(b) When static meters are fitted with inhibiting circuits, they may be tested for non-registration with a current, which is less than the threshold current in respect of a meter of that type, applied to the current circuits and a voltage of 100% of the declared system voltage applied to the voltage circuits of the meters under test. Meters shall not emit more than one output pulse over the minimum test period (t) determined as follows—

$$t = 126000 V \times I \times k \times pf \text{ minutes}$$

where:

V = declared system voltage

I = total current of all phases

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k = number of pulses emitted per kWh by the meter
 pf = power factor.

Method 3

- (c) The period calculated for Method 1 or Method 2 may be halved if the meters under test do not emit any output pulses during the period of the test.

Accuracy tests

3.—(1) Apparatus used for determining the errors of repaired meters during these tests shall comply with the directions.

(2) The rate of advance of a meter over a test period shall be obtained by reading the electro-mechanical register or electronic display on or connected to meters or by monitoring the rotation of a disc or pulse output of a meter.

(3) For any test load, the load applied to a working standard integrating meter shall not be less than 25% or more than 125% of its full load rating.

(4) For a working standard wattmeter, the applied load shall not be less than 40% or more than 100% of its full scale or range reading.

Methods of accuracy test

4. Method A test

4.—(1) A long period dial test where the advance of a kWh display, which is part of or connected to a meter under test, is compared with the advance of a precision kilowatt-hour meter.

Method B test

(2) A short period test where the rate of advance of a meter under test is compared to the rate of advance of a precision kilowatt-hour meter.

Method C test

(3) A short period test where the actual rate of advance of a meter when tested under constant power conditions over a specified test period, is compared to the calculated rate of advance for those conditions.

Conditions for all testing

- 5.—(1) The tests shall be carried out in accordance with Table 1.

Meter position

(2) The meter position requirement given in Table 1 applies to induction meters only. Tolerance applies to the vertical wall on which the meter base is mounted and a horizontal reference line or edge on the meter such as the lower edge of the terminal block.

Voltage and current supplies for polyphase meters

- (a) (3) (a) The order of the phases shall correspond to the sequence shown on the connection diagram.
- (b) The voltages shall be balanced so that the voltage between any line and neutral or between any two lines shall not differ by more than 1.5% from the mean of the corresponding voltages.

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- (c) The currents shall be balanced so that the current in any conductor shall not differ by more than 2.5% from the mean of these currents.
- (d) The phase displacement between the current and corresponding phase to neutral voltage shall not differ from other current and voltage phase displacements by more than 3° at any power factor under any specified load conditions.

External magnetic induction

(4) The test given in Table 1 in respect of external magnetic induction shall be carried out during commissioning or after major modification or refurbishing of a meter testing system. The test consists of determining the errors at 0.11b unity power factor with the meters normally connected and then determining the errors —

- (a) for single phase meters, after reversing both current and voltage connections, for which half the difference between the two errors is the value of the variation;
- (b) for polyphase meters, by making two additional measurements after each of the connections to the current circuits and to the voltage circuits are changed over 120° but with the phase sequence unaltered, for which the greatest difference between each error determined and the mean of the three errors is the value of the variation.

Dial tests

(5) Where all the errors of repaired meters are determined by Method B or Method C test an additional test in accordance with Method A shall be carried out. The Method A test shall be carried out at one of the loads used for the Method B or Method C test. The error obtained by the Method A test shall not differ by more than 0.6% from the error obtained at the same load value by the Method B or Method C test.

Duration of test

(6) The tests described in paragraph 4 shall continue until the error of meters can be calculated within a tolerance not greater than $\pm 0.2\%$.

Conditions for mixing methods of tests

(7) Method A tests may be used for intermediate and high loads, at unity and at 0.5 power factor, and Method B or Method C tests for the low load, provided that an additional Method B or Method C test is carried out at one of the test load values used for the Method A tests.

Test loads

1.—(1) Every repaired meter shall be tested at each of the loads specified in Table 2, except that test number 2 in that Table may be omitted.

(2) Every new meter shall be calibrated and tested at a sufficient number of load points so as to ensure that meter errors are not greater than the limits specified in paragraph 9.

(3) A test for starting will also be carried out on new meters in accordance with test number 7 of Table 2.

(4) The ratio errors shall be determined for voltage transformers that are intended for use with meters but are not tested with a meter.

(5) Current transformers intended for use with meters but not tested with a meter shall be tested from 5% to 120% of rated current.

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Multi-register meters

7. Induction meters

- (a) 7. (1) (a) All induction meters with more than one register shall be tested on one register in accordance with paragraphs 5 and 6 and on each and every other register at a low load using Method A, Method B or Method C tests and at a high load using Method A test.
- (b) For the same load conditions the maximum permitted difference between the error on one register (expressed as a percentage) and the error on any other register (expressed as a percentage) is one.

Static meters

- (a) (2) (a) All static meters with more than one register shall be tested on one register in accordance with paragraphs 5 and 6.
- (b) For repaired meters with more than one register —
 - (i) where the total units are the sum of all the registers, a further test shall be carried out on each and every other register using Method A but
 - (ii) where the total units are recorded on one register, only that register is required to be tested in accordance with paragraphs 5 and 6.

Ployphase meters

8.—(1) very polyphase meter shall be tested on a circuit having a phase relationship for which that meter is designed. However, three phase, four wire polyphase meters may be tested without current in the neutral conductor.

- (2) Polyphase meters shall be tested by using—
 - (a) a polyphase kilowatt-hour energy standard;
 - (b) 2 or 3 singlephase kilowatt-hour energy standards; or
 - (c) 2 or 3 singlephase wattmeters.

Margins of Error

- 9.—(1) The maximum error permitted for—
 - (a) single phase and polyphase whole current meters; and
 - (b) single phase and polyphase transformer operated meters when tested with transformers connected

shall not exceed plus or minus 1.5% for tests numbers 1, 2, 3 and 4 given in Table 2.

(2) The maximum error permitted for both single phase and polyphase transformer operated meters, when tested without transformers connected, shall not exceed plus or minus 1.0% for tests numbers 1, 2, 3 and 4 given in Table 2.

(3) The maximum error permitted for polyphase whole current and transformer operated meters, when tested with transformers connected, shall not exceed plus 1.7% or minus 2.7% for tests 5 and 6 given in Table 2.

(4) The maximum error permitted for polyphase transformer operated meters, when tested without transformers connected, shall not exceed plus 1.2% or minus 2.2% for test numbers 5 and 6 given in Table 2.

(5) Where current and voltage transformers, which are intended to be used with meters, are not tested connected to a meter then the total error of the transformers at any load point throughout the rated range shall not exceed 0.5%.

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Insulation property test

10. Each meter shall be tested to demonstrate that the insulation of the meter is of a sufficient standard to enable the meter to operate safely and correctly in the conditions in which it could reasonably be expected to be installed and operated.

TABLE 1

<i>Influence Quantities</i>	<i>Reference Value</i>	<i>Tolerance</i>
Ambient temperature	Reference temperature or, if not indicated, 23°C.	>15°C to <30°C ±3°
Meter Position	Vertical	±1.5%
Voltage	Reference voltage	±0.5%
Frequency	Reference frequency 50Hz	
Voltage and current waveform	Sinusoidal form	Distortion factor <5%
External magnetic induction at the reference frequency (paragraph 5(4))	Zero	Induction value that does not produce a relative error variation of more than ±0.3%

TABLE 2

<i>Test Number and Load</i>	<i>Power Factor</i>	<i>Test load in terms of marked current</i>				<i>Meter Type</i>	<i>Polyphase Meter Load</i>
		<i>Basic/ Maximum</i>	<i>Maximum continuous</i>	<i>Long Range</i>	<i>Short Range</i>		
1 (high)	1	I _{max}	100%	100%-200% (Note 1)	100%-125% (Note 1)	Single and polyphase	Balanced
2 (intermediate)	1	I _b or 125% I _b	Any load between 25%-75% of the value specified for Test Number 1			Single and polyphase	Balanced
3 (low)	1	5% I _b	1,67% (Note 2)	5%	5%	Single and polyphase	Balanced
4 (inductive)	0.5 (Note 3)	I _b or I _{max}	100%	The same value selected for Test Number 1		Single and polyphase	Balanced
5 (element)	1	I _b	100%	The same value selected for Test Number 1		Polyphase	One phase loaded in turn
Note 1		Where a range is given, any value within that inclusive range may be selected.					
Note 2		For maximum continuously rated prepayment meters, the low load test value may be twice the value shown.					
Note 3		For Test Numbers 4 and 6, the inductive power factor shall be between 0.45 and 0.55 inclusive.					

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6 (inductive) (element)	0.5 (Note 3)	Ib	100%	The same value selected for Test Number 1		Polyphase	One phase loaded in turn
7 (starting-current)	1	0.5% Ib to 1.0% Ib	0.5% to 1.0%	0.5% to 1.0%	0.5% to 1.0%	Single and polyphase	Balanced
Note 1	Where a range is given, any value within that inclusive range may be selected.						
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