



1 CD OIML R 46-4

Date: **19 December 2022**

Reference number: **TC12_p1_N058**

Supersedes document:

<p>OIML TC 12 Instruments for measuring electrical quantities</p> <p>Secretariat/Convenor: Phillip Mitchell, Australia Email: Phillip.mitchell@measurement.gov.au</p>	<p>Circulated to P- and O-members and liaison bodies and external organisations for:</p> <p><input checked="" type="checkbox"/> Discussion at meeting on June 2023</p> <p><input checked="" type="checkbox"/> Comments by: 6 April 2023</p> <p><input type="checkbox"/> Vote (P-members only) and comments by:</p>
--	--

TITLE OF THE CD (English):

OIML R 46-4

Electrical Energy Meters – Alternating Current (a.c.)

Part 4: Evaluation report format

Contents

1	Information	5
1.1	Meter information.....	5
1.2	Meter specification	5
2	Units and current.....	7
3	Metrological requirements	7
3.1	Accuracy requirements	7
3.2	Influence factors	7
3.3	Disturbances	8
3.4	Durability.....	8
4	Technical requirements	9
4.1	Meter markings.....	9
4.2	Metrological seals.....	10
4.3	Evaluation of software-controlled meters	11
4.4	Readability of result.....	12
4.5	Test output	13
4.6	Test mode for demand meters.....	13
4.7	Direction of energy flow.....	14
4.8	Demand meters	15
4.9	Requirements for interval and multi-tariff meters	16
4.10	Requirements for internal clocks	16
4.11	Remote displays.....	17
4.12	Modular components	17
5	Requirements for kinds of meters	18
5.1	Multi-branch meters	18
5.2	Street light meters	19

Foreword

[To be added]

Explanatory Notes

Meaning of symbols used in this report

base m.p.e	=	base maximum permissible error
f_{nom}	=	nominal frequency
U_{nom}	=	nominal voltage
I_{max}	=	maximum current
I_{tr}	=	transitional current
I_{min}	=	minimum current
I_{st}	=	starting current
H1	=	humidity class 1: enclosed locations where the instruments are not subjected to condensed water, precipitation, or ice formations
H2	=	humidity class 2: enclosed locations where the instruments may be subjected to condensed water, to water from sources other than rain and to ice formations.
H3	=	humidity class 3: open locations with average climatic conditions

1 Information

1.1 Meter information

Manufacturer and type

Meter manufacturer:	
Meter type (model designation):	

1.2 Meter specification

Accuracy and measurement quantities

Accuracy class:	<input type="checkbox"/> A / 2	<input type="checkbox"/> B / 1	<input type="checkbox"/> C / 0.5	<input type="checkbox"/> D / 0.2	<input type="checkbox"/> E / 0.1
Quantities (electrical energy):	<input type="checkbox"/> Active	<input type="checkbox"/> Reactive	<input type="checkbox"/> Apparent		
Demand metering:	<input type="checkbox"/> Yes	<input type="checkbox"/> No			

Electrical parameters

Nominal frequency, f_{nom} :		Hz
Nominal voltage, U_{nom} :		V
Maximum current, I_{max} :		A
Transitional current, I_{tr} :		A
Minimum current, I_{min} :		A
Starting current, I_{st} :		A

Environment

Lower specified temperature:	<input type="checkbox"/> -55 °C	<input type="checkbox"/> -40 °C	<input type="checkbox"/> -25 °C	<input type="checkbox"/> -10 °C	<input type="checkbox"/> +5 °C
Upper specified temperature:	<input type="checkbox"/> +30 °C	<input type="checkbox"/> +40 °C	<input type="checkbox"/> +55 °C	<input type="checkbox"/> +70 °C	
Humidity class:	<input type="checkbox"/> H1	<input type="checkbox"/> H2	<input type="checkbox"/> H3		
For use:	<input type="checkbox"/> Outdoor	<input type="checkbox"/> Indoor use only			

Connection mode(s)

<input type="checkbox"/> Direct-connected	<input type="checkbox"/> Current transformer	<input type="checkbox"/> Current and voltage transformers
---	--	---

Phases, wires, elements:	
--------------------------	--

Direction of energy flow and load balance

<input type="checkbox"/> Single-register, bi-directional	<input type="checkbox"/> Single-register, positive direction only
<input type="checkbox"/> Two-register, bi-directional	<input type="checkbox"/> Single-register, uni-directional

For bi-directional and poly-phase meters:

<input type="checkbox"/> Concurrent flow of current in the positive and negative directions on different phases

Testability

Meter constant, active energy:		(include units of measurement)
Meter constant, reactive energy:		(include units of measurement)
Meter constant, apparent energy:		(include units of measurement)

Number of pulses to ensure a standard deviation of measurement less than 0.1 base m.p.e.:

at maximum current, I_{max} :	
at transitional current, I_{tr} :	
at minimum current, I_{min} :	

Interval meter

Interval data storage capability:

Internal clock

Clock type(s): ☐ Synchronous ☐ Crystal-controlled

Hardware and software

Hardware version(s):

Software version(s):

Specified clock output frequencies: *(include units of measurement)*

Remarks

2 Units and current

Requirements	Passed	Failed	Remarks
Units of measurement (OIML R 46-1, 5.1)			
Valid units for active energy: Wh, kWh, MWh, GWh			
Valid units for reactive energy: varh, kvarh, Mvarh, Gvarh			
Valid units for apparent energy: VAh, kVAh, MVAh, GVAh			
For demand meters, the units of measurement for demand			
Minimum current ratios (OIML R 46-1, 6.1.3; Table 1; Table 2)			
Check I_{\max}/I_{tr} ratio complies			
Check I_{\max}/I_{\min} ratio complies			
Check I_{\max}/I_{st} ratio complies			

3 Metrological requirements

3.1 Accuracy requirements

The meter has been tested for accuracy requirements:

Accuracy requirements (OIML R 46-1, 6.2)	Passed	Failed	Remarks
Base maximum permissible errors: for all applicable measurement quantities and directions			
No load			
Starting current			

3.2 Influence factors

The meter has been tested for the allowed effects of influence factors:

Influence factors (OIML R 46-1, 6.3)	Passed	Failed	Remarks
Temperature; temperature dependence			
Self-heating			
Load balance			
Voltage variation			
Frequency variation			
Harmonics in voltage and current circuits			
Integral cycle load control test			
Odd harmonics in the current circuit			
High-order harmonics			
DC in the AC current circuit			
Reversed phase sequence			
Magnetic field (AC, power frequency) of external origin; 400 A/m			
Radiated, RF, electromagnetic fields; with current			
Conducted disturbances, induced by radio frequency fields			
Fast load current variation			

3.3 Disturbances

The meter has been tested for the allowed effects of disturbances:

Disturbances (OIML R 46-1, 6.4)	Passed	Failed	Remarks
Magnetic field (AC, power frequency) of external origin			
Electrostatic discharges			
Fast transients			
Severe voltage variations			
One or two phases interrupted			
Continuous (DC) magnetic induction of external origin			
Voltage dips and interruptions			
Radiated, RF, electromagnetic fields			
Surges on AC mains power lines			
Damped oscillatory waves immunity test			
Short-time overcurrent			
Impulse voltage			
Earth fault			
Operation of auxiliary devices			
Vibration			
Shock			
Protection against solar radiation			
Dry heat			
Cold			
Damp Heat			
Durability			
Ring wave			
Differential mode current disturbances (2-150 kHz)			

3.4 Durability

Provide the period of time, specified by the manufacturer, over which the meter is designed to maintain an adequate stability of its metrological characteristics and evidence to support the durability claim. Also describe any methods of durability protection.

4 Technical requirements

4.1 Meter markings

Meter markings (OIML R 46-1, 7.1)	Marked on meter?		Remarks	
All meters (OIML R 46-1, 7.1.1)				
a) Manufacturer				
b) Manufacturer address				
c) U_{nom}				
d) I_{max}				
e) I_{tr}				
f) I_{min}				
g) I_{st}				
h) Approval mark(s)				
i) Serial number				
j) Number of phases				
k) Number of wires				
l) Register multiplier (if other than unity)				
m) Meter constant(s)				
n) Year of manufacture				
o) Accuracy class				
p) Directionality of energy flow				
q) Meter type (model designation)				
r) Temperature range				
s) Humidity and water protection information				
t) Impulse voltage protection information				
u) f_{nom}				
v) The connection mode(s) for which the meter is specified				
w) Connection terminals uniquely identified to distinguish between terminals				
Demand meters (OIML R 46-1, 7.1.2)				
1) Response period or demand interval				
2) Update interval (if applicable)				
3) Maximum demand rating				
4) All information essential for determination of the demand from the meter indication.				
5) For primary rated meters: a) Current transformer rating, e.g. CT 100-5 A b) Voltage transformer rating, e.g. VT				
Marking requirements (OIML R 46-1, 7.1.1)		Passed	Failed	Remarks
Markings are indelible, distinct and legible from outside the meter				
Serial number is affixed in a position that is not readily disassociated from the meter				

4.2 Metrological seals

Describe the physical metrological seals. Include how they seal the meter case, and connection terminals of the transformers including LPITs, both at the meter and at the LPIT end

Requirements for metrological seals (OIML R 46-1, 7.2)	Passed	Failed	Remarks
Meter case has means for applying a metrology seal(s)			
The connection terminals of the transformers including LPITs, both at the meter and at the LPIT end, have means for being sealed with a metrology seal.			

4.3 Evaluation of software-controlled meters

Describe the software and indicate the version of the software present at the time of testing, and how to identify the software version

--

Requirements for software-controlled meters (OIML R 46-1, Annex B)	Validation Description	Passed	Failed
Software identification (B.2.1)			
Correctness of metrological algorithms and functions (OIML R 46-1, B.2.2)			
Software securing and protection (OIML R 46-1, B.2.3)			
Audit trails (OIML R 46-1, B.2.4)			
Prevention of misuse (OIML R 46-1, B.2.5)			
Support of fault and defect detection (OIML R 46-1, B.2.6)			
Shared indications (OIML R 46-1, B.3.1.4)			
Protection of stored data (OIML R 46-1, B.3.3.2)			
Automatic storage (OIML R 46-1, B.3.3.3)			
Deletion of stored data (OIML R 46-1, B.3.3.4)			
Protection of transmitted data (OIML R 46-1, B.3.4.2)			
Transmission delay or interruption (OIML R 46-1, B.3.4.3)			
Indications from dynamic modules of legally relevant software (OIML R 46-1, B.3.5)			

4.4 Readability of result

Describe the indicating device(s) including the type (electronic or mechanical), all relevant measurement data displayed, display format, and instructions on how to use it.

Requirements for readability of result (OIML R 46-1, 7.4.1)	Passed	Failed	Remarks
The meter has one (or more) indicating device(s)			
The indicating device is easy to read.			
The characters of measurement results are at least 4 mm high.			
Any decimal fractions are clearly indicated			
For mechanical registers, any decimal fraction drum is marked differently.			
The indicating device is able to display all data relevant for billing purposes.			
It is possible to display the content of all relevant memories.			
For automatic sequencing displays, each display of register for billing purposes is retained for a minimum of 5 s.			
For multi-tariff meters, the register which reflects the active tariff is indicated			
It is possible to read each tariff register locally and each register is clearly identified.			
Electronic registers are non-volatile so that they retain stored values upon loss of power. Stored values shall not be overwritten and shall be capable of being retrieved upon restoration of power.			
The register is capable of storing and displaying an amount of energy that corresponds to the meter running at $P = U_{\text{nom}} \times I_{\text{max}} \times n$ for at least 4000 h, where n is the number of phases. This capability for storage and display applies to all registers relevant for billing including positive and negative flow registers for bi-directional meters and tariff registers for multi-tariff meters.			
In the case of electronic registers, the minimum retention time for results is one year for a disconnected meter.			
Electronic indicating devices have a display test that switches all the display segments on then off for the purpose of determining whether all display segments are working.			

4.5 Test output

Describe the test output(s).

--

Requirements for test output (OIML R 46-1, 7.4.2.1)	Passed	Failed	Remarks
The meter is equipped with a test output for efficient testing			
The wavelength of radiated signals is between 550 nm to 1000 nm.			
The radiation strength E_T complies with limits at on and off conditions (see OIML R 46-1, 7.4.2.1)			

Testing for meter constants:

Meter constant(s) (OIML R 46-1, 7.4.2.1)	Passed	Failed	Remarks
The relation between the measured energy given by the test output and the measured energy given by the indicating device complies with the meter constant marking on the name-plate.			
If the meter is capable of supporting multiple meters constants, or a range of meter constants, all shall correctly express the relation between the measured energy given by the test output and the measured energy given by the indicating device.			

4.6 Test mode for demand meters

[To be completed]

4.7 Direction of energy flow

Describe the category of meter specifying the kinds of registers and capability to measure energy in different directions. Also specify how the polarity of energy flow is defined by the manufacturer's connection instructions.

Requirements for direction of energy flow (OIML R 46-1, 7.6)	Passed	Failed	Remarks
For bi-directional meters, energy registration occurs in the correct register when the direction of flow changes			
[Add for apparent energy meters – 7.6.2]			

4.8 Demand meters

[To be added]

4.9 Requirements for interval and multi-tariff meters

Describe any interval data and multi-tariff functionality and capabilities.

--

Requirements for interval and multi-tariff meters (OIML R 46-1, 7.8)	Passed	Failed	Remarks
For interval meters, the summation of interval data equates to the cumulative register value over the same period			
For multi-tariff meters, only a single tariff register (in addition to the cumulative register) is active at any time.			
For multi-tariff meters, the summation of values recorded in each multi-tariff register equates to the value recorded in the cumulative register			

4.10 Requirements for internal clocks

Internal clock(s) have been tested:

Internal clocks (OIML R 46-1, 7.9)	Passed	Failed	Remarks
The synchronous clock meets the timekeeping accuracy requirements.			
The crystal-controlled clock meets the timekeeping accuracy requirements.			

4.11 Remote displays

[To be added]

4.12 Modular components

[To be added]

5 Requirements for kinds of meters

5.1 Multi-branch meters

Describe the features and functions of the multi-branch meter.

--

Requirements for multi-branch meters (OIML R 46-1, Annex A)	Passed	Failed	Remarks
For interval meters, the summation of interval data equates to the cumulative register value over the same period			
For multi-tariff meters, only a single tariff register (in addition to the cumulative register) is active at any time.			
For multi-tariff meters, the summation of values recorded in each multi-tariff register equates to the value recorded in the cumulative register			

Describe the testing of the multi-branch meter.

--

The multi-branch meters has been tested:

Multi-branch meters (OIML R 46-1, Annex A)	Passed	Failed	Remarks
Single-phase connections			
Three-phase connections.			
Cross-channel influences			
Configurations			
Family of LPITs			
1) Determination of initial intrinsic error			
2) Starting current			
3) Test of no-load condition			

5.2 Street light meters

[To be added]