INTERNATIONAL RECOMMENDATION

# OIML R 49-4

Edition 2024 (E)

# Water meters for cold potable water and hot water.

## Part 4: Type evaluation report format

Compteurs d'eau potable froide et d'eau chaude.

Partie 4: Format du rapport d'évaluation de type

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

# Contents

# Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organisation whose primary aim is to harmonise the regulations and metrological controls applied by the national metrological services, or related organisations, of its Member States. The main categories of OIML publications are:

- **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity. OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D),** which are informative in nature and which are intended to harmonise and improve work in the field of legal metrology;
- **International Guides (OIML G),** which are also informative in nature and which are intended to give guidelines for the application of certain requirements to legal metrology;
- **International Basic Publications (OIML B),** which define the operating rules of the various OIML structures and systems; and

OIML Draft Recommendations, Documents and Guides are developed by Project Groups linked to Technical Committees or Subcommittees which comprise representatives from OIML Member States. Certain international and regional institutions also participate on a consultation basis. Cooperative agreements have been established between the OIML and certain institutions, such as ISO and the IEC, with the objective of avoiding contradictory requirements. Consequently, manufacturers and users of measuring instruments, test laboratories, etc. may simultaneously apply OIML publications and those of other institutions.

International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision.

Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

This publication – reference OIML R 49-4:2024 (E) – was developed by OIML TC 8/SC 5/p5 *Water meters*. The content is the “checklist” requirements taken from OIML R 49-3:2013. OIML R 49-4:2024 was approved for final publication by the International Committee of Legal Metrology at its 59th meeting in October 2024. It will be submitted to the International Conference on Legal Metrology in 2025 for formal sanction.

OIML Publications may be downloaded from the OIML web site in the form of PDF files. Additional information on OIML Publications may be obtained from the Organization’s headquarters:

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# Introduction

The “Type evaluation report format”, the subject of OIML R 49-4, aims at presenting, in a standardised format, the results of the evaluation to which a type of a water meter for cold potable water and hot water shall be submitted with a view to its approval.

The “Checklist” is a summary of the evaluation and examinations carried out on the instrument. It includes the conclusions of the results of the tests performed experimental or visual checks based on the required performance criteria and associated tests in OIML R 49-1 and R 49-2. The words or condensed sentences intend to remind the examiner of the requirements of R 49-1 and R 49 -2 without reproducing them.

All metrology services evaluating types of water meters for cold potable water and hot water according to OIML R 49-1 and R 49-2 or to national or regional regulations based on OIML R 49-1 and R 49-2 are strongly advised to use this “Type evaluation report format”, directly or after translation into a language other than English or French. Its direct use in English or in French, or in both languages, is even more strongly recommended whenever the results of type evaluation may be transmitted by the country performing these evaluations to the approving authorities of another country, under bi- or multi-lateral cooperation agreements. In the framework of the OIML Certification System (OIML-CS), use of the “Type evaluation report format” is mandatory.

# 1 Explanatory notes

| Symbol | Meaning |
|---|---|
| + | pass |
| – | fail |
| n/a | not applicable |
| EUT | equipment under test |
| H | horizontal |
| MAP | maximum admissible pressure |
| MAT | maximum admissible temperature |
| MPE | maximum permissible error |
| V | vertical |

## 1.1 Identification of the instrument

| | | | |
|---|---|---|---|
| Application no.: | ……..... | Type designation: | ……..... |
| Identification no.: | ……..... | Manufacturer: | ……..... |
| Software version: | ……... | | |
| Report date: | ……..... | | |

Documentation from the manufacturer

(Record as necessary to identify the equipment under test)

| System or module name | Drawing number or software reference | Issue level | Serial no. |
|---|---|---|---|
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
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| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |

Simulator documentation (if applicable)

| System or module name | Drawing number or software reference | Issue level | Serial no. |
|---|---|---|---|
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... |

## 1.2 Identification of the instrument (continued)

| | | | |
|---|---|---|---|
| Application no.: | ……..... | Type designation: | …...……..... |
| Identification no.: | ……..... | Manufacturer: | …...……..... |
| Software version: | ……..... | | |
| Report date: | ……..... | | |

Simulator function (summary) (if applicable)

Simulator description and drawings, block diagram, etc. should be attached to the report if available.

## 1.3 Identification of the instrument (continued)

| | | | |
|---|---|---|---|
| Application no.: | ……..... | Type designation: | …...……..... |
| Identification no.: | ……..... | Manufacturer: | …...……..... |
| Software version: | ……..... | | |
| Report date: | ……..... | | |

Description or other information pertaining to identification of the instrument (attach photographs and images):

## 1.4 General information concerning the type

| | | | |
|---|---|---|---|
| Application no.: | …..……..... | Type designation: | …..……..... |
| Identification no.: | …..……..... | Manufacturer: | …..……..... |
| Software version: | …..……..... | | |
| Report date: | …..……..... | | |

☐ Complete instrument ☐ Module[1]

Evaluation period: ……
Date of report: ……
Observer: ……

[1] The test equipment (simulator or part of a complete instrument) connected to the module shall be defined in the test form(s) used.

## 1.5 General information concerning the type (continued)

| | | | |
|---|---|---|---|
| Application no.: | ……..... | Type designation: | …..……..... |
| Identification no.: | ...……..... | Manufacturer: | …..……..... |
| Software version: | ...……..... | | |
| Report date: | ...……..... | | |

☐ Complete instrument ☐ Module[2]

Use this space to indicate additional remarks and/or information: other connected equipment, interfaces, choice of the manufacturer regarding protection against disturbances, etc.

[2] The test equipment (simulator or part of a complete instrument) connected to the module shall be defined in the test form(s) used.

## 1.6 Configuration for type evaluation

| | | | |
|---|---|---|---|
| Application no.: | ..... | Type designation: | ..... |
| Report date: | ..... | Manufacturer: | ..... |

Use this space for additional information relating to equipment configuration, interfaces, data rates, EMC protection options, etc., for the instrument and/or simulator.

## 1.7 Selection of sample(s)

| | | | |
|---|---|---|---|
| Application no.: | ..... | Type designation: | ..... |
| Report date: | ..... | Manufacturer: | ..... |

Use this space for additional information relating to the identification for the selection of sample(s), in particular in case of a family of instruments or modules or if specific requirements are mentioned in OIML R 49-1 and -2.

## 1.8 Adjustments or modifications

| | | | |
|---|---|---|---|
| Application no.: | ..... | Type designation: | ..... |
| Report date: | ..... | Manufacturer: | ..... |

Use this space for additional information relating to the identification of any authorised and agreed upon adjustments or modifications made to the sample or samples during the evaluation.

## 2 Summary of test report(s)

Use the table below to summarise the tests report(s) used to support the type evaluation:

| Test report number | Issued by | Date issued | Version number | Remarks * |
|---|---|---|---|---|
| | | | | |
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*Use this column to record if the test report was issued:

- under the OIML Basic Certificate System, the OIML Mutual Acceptance Arrangement (MAA) or the OIML Certification System Scheme A or B, where the test report was used as the basis for issuing an existing OIML certificate, the relevant OIML certificate number should be noted.
- By a Manufacturer's Test Laboratory (MTL).
- Where the test report was issued outside the scope of an ISO/IEC 17025 accreditation, an explanation and justification of the use of the test report is required.

## 2.1 Summary of appraisal of test data (where applicable)

Use this page to record the appraisal of test data [reference OIML-CS PD-05 and PD-07]:

## 2.2 Summary of the checklist

For each test, the “Summary of the checklist” and the “Checklist” shall be completed according to this example:

| | Passed | Failed |
|---|---|---|
| when the instrument has passed the test: | X | |
| when the instrument has failed the test: | | X |
| when the test is not applicable: | / | / |

Summary of the checklist:

| Requirements | Passed | Failed | Remarks |
|---|---|---|---|
| Metrological requirements<br>R 49-1, clause 4 | | | |
| Requirements for electronic instruments<br>R 49-1, clause 5 | | | |
| Technical requirements<br>R 49-1, clause 6 | | | |
| Metrological controls<br>R 49-1, clause 7 | | | |
| Test procedures<br>R 49-2 | | | |
| Overall results | | | |

Application no.: ---------- Type designation: ----------

Report date: ---------- Manufacturer: ----------

Use this space to detail remarks from the summary of the checklist.

| **External examination for all water meters** | | | | |
|---|---|---|---|---|
| ***Requirements for meters and ancillary devices*** | | | | |
| **OIML R 49-1: 2024 subclause** | **Requirement** | **+** | **−** | **Remarks[3]** |
| 4.3.1 | Requirements for meters and ancillary devices<br><br>The connections between the measurement transducer, the calculator and the indicating device shall be reliable and durable in accordance with OIML R 49-1:2024, 5.1.4 and Annex B2.<br><br>These provisions shall also apply to connections between the primary and secondary devices of electromagnetic meters | | | |
| 4.3.2 | Adjustment device<br><br>A meter may be provided with an electronic adjustment device, which may replace a mechanical adjustment device. | | | |
| 4.3.3 | Correction device<br><br>A meter may be fitted with correction devices; such devices are always considered as an integral part of the meter. The whole of the requirements which apply to the meter, in particular the MPEs specified in OIML R 49-1:2024, 4.2, are therefore applicable to the corrected volume at metering conditions.<br><br>In normal operation, non-corrected volume shall not be displayed.<br><br>A water meter with correction devices shall satisfy the performance tests of OIML R 49-1:2024, Annex A5.<br><br>All the parameters which are not measured and which are necessary for correcting shall be contained in the calculator at the beginning of the measurement operation.<br><br>The correction device shall not allow the correction of a pre-estimated drift, e.g., in relation to time or volume.<br><br>Associated measuring instruments shall be fitted with checking facilities, as specified in OIML R 49-1:2024, Annex B6.<br><br>Correction devices shall not be used for adjusting the errors (of indication) of a water meter to values other than as close as practical to zero, even when these values are within the MPEs.<br><br>Conditioning of the water at flow rates below $Q_1$ by means of a moving device, e.g. spring-loaded flow accelerator, shall not be permitted. | | | |

| | | | | |
|---|---|---|---|---|
| 4.3.4 | Calculator<br><br>All parameters necessary for the elaboration of indications that are subject to legal metrological control, such as a calculation table or correction polynomial, shall be present in the calculator at the beginning of the measurement operation.<br><br>The calculator may be provided with interfaces permitting the coupling of peripheral equipment. When these interfaces are used, the hardware and software of a water meter shall continue to function correctly and the metrological functions of the meter shall not be capable of being affected. | | | |
| 4.3.5 | Indicating device<br><br>The indicating device shall display the volume either continuously, periodically or on demand. It shall be readily available to read. | | | |
| 4.3.6 | In addition to the indicating devices specified in 6.7.2, a water meter may include the ancillary devices specified in 3.1.8.<br><br>Where national regulations permit, a remote reading device may be used for testing and verification and for remote reading of a water meter, provided that other means guarantee the satisfactory operation of the water meter.<br><br>The addition of these devices, either temporary or permanent, shall not alter the metrological characteristics of the meter. | | | |
| 5 | **Water meters equipped with electronic devices** | | | |
| 5.1 | A water meter equipped with electronic devices shall be designed and manufactured in such a way that significant faults do not occur when it is exposed to the disturbances specified in OIML R 49-1:2024, Annex A5. | | | |
| 5.1.2 | A significant fault shall have a value equal to one half of the MPE in the upper flow rate zone. | | | |
| 5.1.3 | A water meter with electronic devices shall be provided with the checking facilities specified in OIML R 49-1:2024, Annex B, except in the case of non-resettable measurements between two constant partners. | | | |

[3] Use continuation sheet if necessary.

| | | | | |
|---|---|---|---|---|
| | All water meters equipped with checking facilities shall prevent or detect reverse flow, as specified in OIML R 49-1:2024, 4.2.7. | | | |
| 5.1.4 | A water meter is presumed to comply with the requirements in OIML R 49-1:2024, 4.2 and 5.1.1 if it passes the design inspection and performance tests specified in OIML R 49-1:2024, 7.2.12.1 and 7.2.12.2 in the following conditions:<br><br>a) the number of meters submitted shall comply with OIML R 49-1:2024, 7.2.2;<br><br>b) at least one of these meters is submitted to the whole set of tests;<br><br>c) no meter fails any test. | | | |
| 5.1.5 | Sampling interval<br><br>For electronic water meters or mechanical water meters incorporating an electronic indicating device the sampling interval shall be appropriate in order to support the user application and billing period and therefore shall not exceed 10 seconds.<br><br>The sampling interval range shall be indicated in the product documentation available to the user or indicated on the meter, either physically inscribed or via menus accessible on the display. | | | |
| 5.1.6 | Test mode<br><br>Electronic water meters or mechanical water meters incorporating an electronic indicating device may be placed into a specific mode of operation called test mode. The test mode should not alter the ability of the meter to meet the acceptance criteria of any performance tests specified in this part of the standard and in OIML R 49-2: 2024 and may only differ from the specifications set out in this part of the standard and in OIML R 49-2:2024 for the following aspects:<br><br>• Switch the resolution of the indicating device to achieve or exceed requirements of OIML R 49-1:2024, 6.7.3.2.3<br><br>• Switch to a shorter sampling interval than in service operation to achieve or exceed requirements of OIML R 49-1:2024, 6.7.3.2.3, and OIML R 49-1:2024, 7.2, 7.3 | | | |

| | | | | |
|---|---|---|---|---|
| | • Activate output transmission in pulses or digital data format to the test laboratory data acquisition system.<br><br>Test mode may only be used during tests to determine the error (of indication) of the meter. Following the use of test mode for testing purposes the meter shall be able to be placed into an operational/service mode and sealed.<br><br>The manufacturer shall provide the necessary equipment and/or procedures to the test laboratories and national authorities to initiate test mode. | | | |
| 5.1.7 | Software<br><br>For software-controlled water meters, the requirements of OIML R 49-1:2024, Annex D shall apply. | | | |
| **External power supply** | | | | |
| 5.2.2.1 | Water meters with electronic devices shall be designed such that in the event of an external power supply failure (AC or DC), the meter indication of volume just before failure is not lost and remains accessible for a minimum of one year.<br><br>The corresponding memorisation shall occur at least either once per day or for every volume equivalent to 10 min of flow at $Q_3$. | | | |
| 5.2.2.2 | Any other properties or parameters of a meter shall not be affected by an interruption of the electrical supply.<br><br>Meters shall employ means to ensure continued and accurate operation during a short power supply interruption.<br><br>Compliance with this requirement does not necessarily ensure that the meter continues to register volume during a longer-term power supply failure. | | | |
| 5.2.2.4 | Nominal value of mains voltage and frequency<br><br>The manufacturer shall declare the nominal value of mains voltage and frequency. | | | |
| 5.2.3 | Non-replaceable battery<br><br>The power supply connections at a meter shall be capable of being secured from tampering. | | | |
| 5.2.3.1 | The manufacturer shall ensure that the expected lifetime of the battery is such that a meter functions correctly for at | | | |

| | | | | |
|---|---|---|---|---|
| | least one year longer than the operational lifetime of the meter. | | | |
| 5.2.3.2 | A low battery or exhausted battery indicator or a meter replacement date shall be indicated on the meter. If the register display gives an indication of “low battery”, there shall be at least 180 days of useful life for the register display from the time “low battery” indication is displayed to end of life. | | | |
| 5.2.4.1 | Replaceable battery<br><br>Where the electrical power supply is a replaceable battery, the manufacturer shall give precise rules for the replacement of the battery. | | | |
| 5.2.4.2 | A low battery or exhausted battery indicator or a battery replacement date shall be indicated on the meter. If the register display gives an indication of “low battery”, there shall be at least 180 days of useful life for the register display from the time “low battery” indication is displayed to end of life. | | | |
| 5.2.4.3 | The properties and parameters of a meter shall not be affected by the interruption of the electrical supply when the battery is replaced. | | | |
| 5.2.4.4 | Replacement of the battery shall be carried out in a way that does not necessitate breaking the seal required for statutory metrological inspections. | | | |
| 5.2.4.5 | The battery compartment shall be capable of being secured from tampering. | | | |
| **Materials and construction of water meters** | | | | |
| 6.1.1 | A water meter shall be manufactured from materials of adequate strength and durability for the purpose for which it is to be used. | | | |
| 6.1.2 | A water meter shall be manufactured from materials which shall not be adversely affected by the water temperature variations, within the working temperature range (see OIML R 49-1:2024, 6.4). | | | |
| 6.1.3 | All parts of a water meter in contact with the water flowing through it shall be manufactured from materials which are conventionally known to be non-toxic, non-contaminating, and biologically inert and according to national regulations. | | | |
| 6.1.4 | The complete water meter shall be manufactured from materials which are resistant to internal and external | | | |

| | | | | |
|---|---|---|---|---|
| | corrosion or which are protected by a suitable surface treatment. | | | |
| 6.1.5 | A water meter indicating device shall be protected by a transparent window. A cover of a suitable type may also be provided as additional protection. | | | |
| 6.1.6 | Where there is a risk of condensation forming on the underside of the window of a water meter indicating device, the water meter shall incorporate devices for the prevention or elimination of condensation. | | | |
| 6.1.7 | A water meter shall be of such design, composition, and construction that it does not facilitate the perpetration of fraud. | | | |
| 6.1.8 | A water meter shall be fitted with a metrologically controlled display. The display shall be readily accessible to the customer, without requiring the use of a tool. | | | |
| 6.1.9 | A water meter shall be of such design, composition, and construction that it does not exploit the MPE or favour any party. | | | |
| **Adjustment and correction** | | | | |
| 6.2.1 | A water meter may be fitted with an adjustment device, and/or a correction device. Any adjustment and/or correction shall be performed in such a way as to adjust the errors (of indication) of the water meter to values as close as practical to zero so that the meter may not exploit the MPE or systematically favour any party. | | | |
| 6.2.2 | If these devices are mounted on the outside of the water meter, provision for sealing shall be made (see 6.8.2). | | | |
| 6.3 | Installation | | | |
| 6.3.1 | The water meter shall be installed such that it is completely filled with water under normal conditions. | | | |
| 6.3.2 | Under specific installation conditions, a strainer or filter, fitted at the inlet of a meter or in the upstream pipeline, may be required.<br><br>Note that solid particles collect in a water meter, e.g. following work on the pipework upstream from the meter. | | | |
| 6.3.3 | Provision may be made on a water meter to allow it to be correctly levelled during installation. | | | |
| 6.3.4 | If the accuracy of a water meter is affected by disturbances in the upstream or downstream pipeline (e.g. due to the presence of bends, valves or pumps), the water meter shall | | | |

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| | be provided with a sufficient number of straight pipe lengths, with or without a flow straightener, as specified by the manufacturer, so that the indications of the installed water meter meet the requirements of OIML R 49-1, 4.2.2 or 4.2.3 with respect to MPEs and according to the accuracy class of the meter. | | | |
| 6.3.5 | A water meter shall be able to withstand the influence of disturbed velocity fields as defined in the test procedures in OIML R 49-2:2024. During the application of these flow disturbances, the error (of indication) shall meet the requirements of OIML R 49-1, 4.2.2 or 4.2.3.<br><br>Where a water meter may be manufactured and supplied with different lengths (as declared by the manufacturer), the meter with the shortest length shall be tested in order to demonstrate compliance with the requirements of OIML R 49-1, 4.2.2 or 4.2.3.<br><br>A meter manufacturer shall specify the flow profile sensitivity class in accordance with OIML R 49-1, Table 2 and Table 3.<br><br>Any specific flow conditioning section, including straightener and/or straight lengths, to be used shall be prescribed by the manufacturer. | | | |
| 6.4 | 6.4 Rated operating conditions<br><br>The rated operating conditions for a water meter shall be as reported in OIML R 49-1, Table 4. | | | |
| 6.5 | Pressure loss<br><br>Row given further down the checklist to be completed. | | | |
| 6.6 | Marks and inscriptions<br><br>Rows given further down the checklist to be completed. | | | |

# 3 Checklist for water meter examinations and performance tests

## 3.1 Checklist for water meter examinations

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Function of the indicating device** | | | | |
| 6.7.1.1 | The indicating device shall provide an easily read, reliable and unambiguous visual indication of the indicated volume. | | | |
| 6.7.1.1 | The indicating device shall include visual means for testing and calibration. | | | |
| 6.7.1.1 | The indicating device may include additional elements for testing and calibration by other methods, e.g. for automatic testing and calibration. | | | |
| **Unit of measurement and its placement** | | | | |
| 6.7.1.2 | The indicated volume of water shall be expressed in cubic metres | | | |
| 6.7.1.2 | The symbol $m^3$ shall appear on the dial or immediately adjacent to the numbered display | | | |
| **Indicating range** | | | | |
| 6.7.1.3 | For $Q_3 \leq 6.3$, the minimum indicating range is 0 $m^3$ to 9 999 $m^3$ | | | |
| 6.7.1.3 | For $6.3 < Q_3 \leq 63$, the minimum indicating range is 0 $m^3$ to 99 999 $m^3$ | | | |
| 6.7.1.3 | For $63 < Q_3 \leq 630$, the minimum indicating range is 0 $m^3$ to 999 999 $m^3$ | | | |
| 6.7.1.3 | For $630 < Q_3 \leq 6\,300$, the minimum indicating range is 0 $m^3$ to 9 999 999 $m^3$. See footnote 4. | | | |
| **Colour coding for indicating device** | | | | |
| 6.7.1.4 | The colour black should be used to indicate the cubic metre and its multiples. | | | |

[4] may be expanded to larger values of $Q_3$

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| 6.7.1.4 | The colour red should be used to indicate sub-multiples of a cubic metre. | | | |
| 6.7.1.4 | The colours shall be applied to either the pointers, indexes, numbers, wheels, discs, dials or aperture frames. | | | |
| 6.7.1.4 | Other means of indicating the cubic metre may be used provided there is no ambiguity in distinguishing between the primary indication and alternative displays, e.g. sub-multiples for verification and testing. | | | |
| **Types of indicating device: Type 1 — Analogue device** | | | | |
| 6.7.2.1 | The indicated volume shall be shown by continuous movement of either:<br><br>a) one or more pointers moving relative to graduated scales; or<br><br>b) one or more circular scales or drums each passing an index. | | | |
| 6.7.2.1 | The value expressed in cubic metres for each scale division shall be of the form $10^n$, where $n$ is a positive or a negative whole number or zero, thereby establishing a system of consecutive decades. | | | |
| 6.7.2.1 | The scale shall be graduated in values expressed in cubic metres or accompanied by a multiplying factor<br><br>(×0.001; ×0.01; ×0.1; ×1; ×10; ×100; ×1 000, etc.) | | | |
| 6.7.2.1 | Rotational movement of the pointers or circular scales shall be clockwise. | | | |
| 6.7.2.1 | Linear movement of pointers or scales shall be left to right. | | | |
| 6.7.2.1 | Movement of numbered roller indicators (drums) shall be upwards. | | | |
| **Types of indicating device: Type 2 — Digital device** | | | | |
| 6.7.2.2 | The indicated volume is given by a line of digits appearing in one or more apertures. | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| 6.7.2.2 | The advance of one digit shall be completed while the digit of the next immediately lower decade changes from 9 to 0. | | | |
| 6.7.2.2 | The apparent height of the digits shall be at least 4 mm. | | | |
| 6.7.2.2 | For non-electronic devices, movement of numbered roller indicators (drums) shall be upwards. | | | |
| 6.7.2.2 | For non-electronic devices, the lowest value decade may have a continuous movement, the aperture being large enough to permit a digit to be read without ambiguity. | | | |
| 6.7.2.2 | For electronic devices with non-permanent displays the volume shall be able to be displayed at any time for at least 10 s. | | | |
| 6.7.2.2 | For electronic devices, the meter shall provide visual checking of the entire display which shall have the following sequence:<br>• for seven segment type displaying all the elements (e.g. an “eights” test); and<br>• for seven segment type blanking all the elements (a “blanks” test).<br>For graphical displays, an equivalent test is required to demonstrate that display faults cannot result in any digit being misinterpreted.<br>Each step of the sequence shall last at least 1 s. | | | |
| **Types of indicating device: Type 3 — Combination of analogue and digital devices** | | | | |
| 6.7.2.3 | The indicated volume is given by a combination of type 1 and type 2 devices and the respective requirements of each shall apply. | | | |
| **Verification devices — General requirements** | | | | |
| 6.7.3.1 | Every indicating device shall provide means for visual, non-ambiguous verification testing and calibration. | | | |
| 6.7.3.1 | The visual verification may have either a continuous or a discontinuous movement. | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| 6.7.3.1 | In addition to the visual verification display, an indicating device may include provisions for rapid testing by the inclusion of complementary elements (e.g. star wheels or discs), providing signals through externally attached sensors. Such a provision may also be used for leak detection. | | | |
| **Verification devices — Visual verification displays** | | | | |
| 6.7.3.2.1 | The value of the verification scale interval, expressed in cubic metres, shall be of the form: $1 \times 10^n$, $2 \times 10^n$ or $5 \times 10^n$, where $n$ is a positive or negative whole number, or zero. | | | |
| 6.7.3.2.1 | For analogue or digital indicating devices with continuous movement of the first element, the verification scale interval may be formed from the division into 2, 5 or 10 equal parts of the interval between two consecutive digits of the first element. Numbering shall not be applied to these divisions. | | | |
| 6.7.3.2.1 | For digital indicating devices with discontinuous movement of the first element, the verification scale interval is the interval between two consecutive digits or incremental movements of the first element. | | | |
| 6.7.3.2.2 | On indicating devices with continuous movement of the first element, the apparent scale spacing shall be not less than 1 mm and not more than 5 mm. | | | |
| 6.7.3.2.2 | The scale shall consist of either:<br><br>a) lines of equal thickness not exceeding one quarter of the scale spacing and differing only in length; or<br><br>b) contrasting bands of a constant width equal to the scale spacing. | | | |
| 6.7.3.2.2 | The apparent width of the pointer at its tip shall not exceed one-quarter of the scale spacing and in no case shall it be greater than 0.5 mm. | | | |
| **Resolution of the indicating device** | | | | |
| 6.7.3.2.3 | Additional verification elements may be used provided that the uncertainty of reading is not greater than 0.25 % of the test volume for accuracy class 1 meters and 0.5 % of the test volume for accuracy | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | class 2 meters and that the correct functioning of the register is checked. | | | |
| 6.7.3.2.3 | When the display of the first element is continuous, an allowance shall be made for a maximum error in each reading of not more than half the verification scale interval. | | | |
| 6.7.3.2.3 | When the display of the first element is discontinuous, an allowance shall be made for a maximum error in each reading of not more than one digit of the verification scale. | | | |
| 6.7.3.3 | 6.7.3.3 Combination meters<br><br>For combination meters with two indicating devices, 6.7.3.1 and 6.7.3.2 apply to both indicating devices. | | | |
| **Marks and inscriptions** | | | | |
| 6.6.1 | A place shall be provided on the meter for affixing the verification mark, which shall be visible without dismantling the meter. | | | |
| 6.6.2 | The water meter shall be clearly and indelibly marked with the information listed in the following, either grouped or distributed on the casing, the indicating device dial, an identification plate or on the meter cover if is not detachable. These markings shall be visible without dismantling the water meter after the instrument has been placed on the market or put into use. | | | |
| *Note:* In the case of a combination meter, the markings in the following refer to the combination meter considered as a single meter. | | | | |
| 6.6.2 a) | Unit of measurement: cubic metre. | | | |
| 6.6.2 b) | The accuracy class, where it differs from accuracy class 2. | | | |
| 6.6.2 c) | Numerical value of $Q_3$ and the ratio $Q_3/Q_1$: if the meter measures reverse flow and the values of $Q_3$ and the ratio $Q_3/Q_1$ are different in the two directions, both values of $Q_3$ and $Q_3/Q_1$ shall be inscribed; the direction of flow to which each pair of values refers shall be clear. The ratio $Q_3/Q_1$ may be expressed as R, e.g. “R160”. If the meter has different values of $Q_3/Q_1$ in horizontal and vertical | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | positions, both values of $Q_3/Q_1$ shall be inscribed, and the orientation to which each value refers shall be clear. | | | |
| 6.6.2 d) | The type approval sign according to national regulations. | | | |
| 6.6.2 e) | The name or trademark of the manufacturer. | | | |
| 6.6.2 f) | The year of manufacture, the last two digits of the year of manufacture or the month and year of manufacture. | | | |
| 6.6.2 g) | The serial number (as near as possible to the indicating device). | | | |
| 6.6.2 h) | The direction of flow by means of an arrow (shown on both sides of the body; or on one side only, provided the direction of flow arrow is easily visible under all circumstances). | | | |
| 6.6.2 i) | The maximum admissible pressure (MAP) if it exceeds 1 MPa (10 bar) or 0.6 MPa (6 bar) for nominal diameter ≥ 500 mm. | | | |
| 6.6.2 j) | The letter V and/or H, if the meter can only be operated in the vertical position and/or horizontal position with the indicating device positioned on top. | | | |
| 6.6.2 k) | The temperature class as specified in Table 1 where it differs from T30. | | | |
| 6.6.2 l) | The pressure loss class where it differs from $\Delta p$ 63. | | | |
| 6.6.2 m) | The installation sensitivity class where it differs from U0/D0. | | | |
| **Additional markings for water meters with electronic devices** | | | | |
| 6.6.2 n) | For an external power supply: the voltage and frequency. | | | |
| 6.6.2 o) | For a replaceable battery: the latest date by which the battery shall be replaced. | | | |
| 6.6.2 p) | For a non-replaceable battery: the latest date by which the meter shall be replaced. | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| 6.6.2 q) | Environmental classification. | | | |
| 6.6.2 r) | Electromagnetic environmental class. | | | |
| 6.6.2 | The environmental classification and electromagnetic environmental class may be given on a separate datasheet, unambiguously related to the meter by a unique identification, and not on the meter itself. | | | |
| **Protection devices** | | | | |
| 6.8.1 | Water meters shall include protection devices which can be sealed so as to prevent, both before and after correct installation of the water meter, dismantling or modification of the meter, its adjustment device or its correction device, without damaging these devices. In the case of combination meters, this requirement applies to both meters. | | | |
| 6.8.1 | The display of the total quantity supplied or the displays from which the total quantity supplied can be derived shall not be resettable while the meter is in service to a single customer. | | | |
| **Protection devices — Electronic sealing devices** | | | | |
| 6.8.2.1 | When access to parameters that influence the determination of the results of measurements is not protected by mechanical sealing devices, the protection shall fulfil the following provisions:<br><br>a) Access shall only be allowed to authorised people, e.g. by means of a code (password) or of a special device (hard key, etc.). The code shall be capable of being changed.<br><br>b) It shall be possible for evidence of an intervention to be available for a period of time as defined in national regulations. The record shall include the date and a characteristic element identifying the authorised person making the intervention [see a)]. If deletion of a previous intervention is necessary to permit a new record, the oldest record shall be deleted. | | | |
| 6.8.2.2 | For meters with parts which can be disconnected one from another by the user and which are | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | interchangeable, the following provisions shall be fulfilled:<br><br>a) it shall not be possible to access parameters that participate in the determination of results of measurements through disconnected points unless the provisions of OIML R 49-1:2024, 6.8.2.1 are fulfilled;<br><br>b) interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities or, if this is not possible, by mechanical means. | | | |
| 6.8.2.3 | For meters with parts which may be disconnected one from the other by the user and which are not interchangeable, the provisions in OIML R 49-1:2024, 6.8.2.2 apply.<br><br>Moreover, these meters shall be provided with devices or means which do not allow them to operate if the various parts are not connected according to the approved type.<br><br>They shall be provided with a device that prevents any measurement after any unauthorised disconnection and subsequent reconnection by the user. | | | |
| **Examination and testing of checking facilities** | | | | |
| **General requirements for examining checking facilities** | | | | |
| 5.1.3 | Water meters with electronic devices shall be provided with the checking facilities (OIML R 49-1, 3.5.4) specified in OIML R 49-1:2024, Annex B. The meter manufacturers shall declare which checking facilities are provided with the meter. | | | |
| 5.1.3 | All water meters equipped with checking facilities shall prevent or detect reverse flow, as laid down in OIML R 49-1:2024, 4.2.7. | | | |

## 3.2 Performance tests for all water meters

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Static pressure test** | | | | |
| 4.2.10 | The meter shall be capable of withstanding the following test pressures without leakage or damage:<br><br>— 1.6 times the maximum admissible pressure for 15 min;<br><br>— 2 times the maximum admissible pressure for 1 min. | | | |
| **Intrinsic errors (of indication)** | | | | |
| 7.2.3 | The errors (of indication) of the water meter (in the measurement of the actual volume), shall be determined at least at the following flow rate ranges:<br><br>a) $Q_1$ to $1.1Q_1$;<br><br>b) $Q_2$ to $1.1\ Q_2$;<br><br>c) $0.33(Q_2 + Q_3)$ to $0.37(Q_2 + Q_3)$;<br><br>d) $0.67(Q_2 + Q_3)$ to $0.74(Q_2 + Q_3)$;<br><br>e) $0.9Q_3$ to $Q_3$;<br><br>f) $0.95Q_4$ to $Q_4$;<br><br>and for combination meters;<br><br>g) $0.85Q_{x1}$ to $0.95Q_{x1}$;<br><br>h) $1.05Q_{x2}$ to $1.15Q_{x2}$.<br><br>The water meter should be tested without its temporary supplementary devices attached (if any).<br><br>During a test all other influence factors shall be held at reference conditions.<br><br>Other flow rates may be tested depending on the shape of the error curve. | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | 1) The errors (of indication) observed for each of the above flow rates shall not exceed the maximum permissible errors (MPEs) given in OIML R 49-1:2024, 4.2.2 or 4.2.3.<br><br>*Note 1:* See OIML R 49-2:2024, 7.4.4 for the permitted flow rate ranges and OIML R 49-2:2024, 7.4.4 and 7.4.5 for the required number of measurements at each flow rate.<br><br>Meters shall be tested in the orientations corresponding to their marking or lack thereof.<br><br>*Note 2:* See OIML R 49-2, 7.4.2.2.7.5 for testing orientations. | | | |
| 7.2.4 | Repeatability<br><br>The meter shall be repeatable: the standard deviation of three measurements at the same flow rate shall not exceed one-third of the MPEs given in OIML R 49-1:2024, 4.2.2 or 4.2.3. Tests shall be carried out at nominal flow rates of $Q_1$, $Q_2$, and $Q_3$. | | | |
| **Water temperature test** | | | | |
| 4.2.8 | The requirements relating to the MPEs shall be met for all water temperature variations within the rated operating conditions of the meter. | | | |
| **Water pressure test** | | | | |
| 4.2.8 | The requirements relating to the MPEs shall be met for all temperature and pressure variations occurring within the rated operating conditions of the water meter. | | | |
| **Reverse flow test** | | | | |
| 4.2.7 | The manufacturer shall specify whether or not a water meter is designed to measure reverse flow. | | | |
| 4.2.7 | A water meter designed to measure reverse flow shall either:<br><br>a) subtract the reverse flow volume from the indicated volume; or | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | b) record the reverse flow volume separately.<br><br>The MPEs of OIML R 49-1:2024, 4.2.2 or 4.2.3 shall be met for both forward and reverse flow.<br><br>For meters designed to measure reverse flow, the permanent flow rate and the measuring range may be different in each direction. | | | |
| 4.2.7 | A water meter not designed to measure reverse flow shall either:<br><br>a) prevent it; or<br><br>b) be capable of withstanding an accidental reverse flow at a flow rate up to $Q_3$ without any deterioration or change in its metrological properties for forward flow. | | | |
| **Meter characteristics at zero flow rate** | | | | |
| 4.2.9 | The water meter totalisation shall not change in the absence either of flow or of water. | | | |
| **Pressure loss test** | | | | |
| 6.5 | The pressure loss of the water meter, including its filter where the latter forms an integral part of the water meter, shall not be greater than 0.063 MPa (0.63 bar) between $Q_1$ and $Q_3$. | | | |
| **Flow disturbance test** | | | | |
| 6.3.4 | If the accuracy of water meters is affected by disturbances in the upstream or downstream pipeline (e.g. due to the presence of bends, valves or pumps), the water meter shall be provided with a sufficient straight pipe lengths with or without a flow straightener (as specified by the manufacturer) so that the indications of the installed water meter do not exceed MPEs of OIML R 49-1, 4.2.2 or 4.2.3, according to the accuracy class of the meter.<br><br>Forward flow tests<br><br>Reverse flow tests (where applicable) | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Overload temperature test** | | | | |
| 7.2.5 | Water meters with MAT ≥ 50 °C shall be capable of withstanding a water temperature of MAT + 10 °C for 1 h.<br><br>The test is specified in OIML R 49-2, 7.6. | | | |
| **Durability tests** | | | | |
| 7.2.6 | The water meter shall undergo a durability test according to the permanent flow rate $Q_3$ and the overload flow rate $Q_4$ of the meter, simulating service conditions.<br><br>The test is specified in OIML R 49-2, 7.11. | | | |
| 7.2.6 | Meters with $Q_3 \leq 16$ m$^3$/h:<br><br>a) 100 000 flow cycles between 0 and $Q_3$;<br><br>b) 100 h at $Q_4$. | | | |
| 7.2.6 | Meters with $Q_3 > 16$ m$^3$/h:<br><br>a) 800 h at $Q_3$;<br><br>b) 200 h at $Q_4$;<br><br>and for combination meters:<br><br>c) 50 000 flow cycles between $Q \geq 2Q_{x2}$ and 0. | | | |
| 7.2.6.2 | Accuracy class 1 meters<br><br>The variation in the error curve (of indication) shall not exceed 2 % for flow rates in the lower zone ($Q_1 \leq Q < Q_2$) and 1 % for flow rates in the upper zone ($Q_2 \leq Q \leq Q_4$).<br><br>For flow rates in the lower flow rate zone ($Q_1 \leq Q < Q_2$), the error (of indication) curve shall not exceed a maximum error limit of ± 4 % for all temperature classes. For flow rates in the upper flow rate zone ($Q_2 \leq Q \leq Q_4$), the error (of indication) curve shall not exceed a maximum error limit of ± 1.5 % for meters of temperature class T30 and ± 2.5 % for all other temperature classes. | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | For the purpose of these requirements, the arithmetic mean values of the errors (of indication) $\overline{E}$ for each flow rate shall apply. | | | |
| 7.2.6.3 | Accuracy class 2 meters<br><br>The variation in the error curve shall not exceed 3 % for flow rates in the lower zone ($Q_1 \leq Q < Q_2$) and 1.5 % for flow rates in the upper zone ($Q_2 \leq Q < Q_4$).<br><br>For flow rates in the lower flow rate zone ($Q_1 \leq Q < Q_2$), the error (of indication) curve shall not exceed a maximum error limit of ± 6 % for all temperature classes. For flow rates in the upper flow rate zone ($Q_2 \leq Q < Q_4$) the error (of indication) curve shall not exceed a maximum error limit of ± 2.5 % for meters of temperature class T30 and ± 3.5 % for all other temperature classes.<br><br>For the purpose of these requirements, the arithmetic mean value of the errors (of indication) $\overline{E}$ for each flow rate shall apply. | | | |
| 7.2.7 | Interchange error<br><br>It shall be demonstrated that cartridge meters and exchangeable metrological modules for water meters with exchangeable metrological modules are independent of the connection interfaces they are made for, as far as their metrological performance is concerned. The cartridge meters and exchangeable metrological modules shall be tested in accordance with the test specified in OIML R 49-2:2024, 7.4.6. | | | |
| 7.2.8 | Static magnetic field<br><br>All water meters where the mechanical components may be influenced by a static magnetic field and all meters with electronic components shall be tested by applying a specified field.<br><br>The test shall be carried out at $Q_3$ and show that the indications of the installed water meter do not exceed MPEs of the upper zone according to the accuracy class of the meter: | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | Forward flow tests<br><br>Reverse flow tests (where applicable)<br><br>Application of the field in different planes<br><br>The test is specified in OIML R 49-2, 7.12. | | | |
| **Documentation** | | | | |
| 7.2.9 | The application for type approval of a water meter or a calculator (including indicating device) or a measurement transducer shall include the following documents: | | | |
| 7.2.9.1 a) | a description giving the technical characteristics and the principle of operation; | | | |
| 7.2.9.1 b) | a drawing or photograph of the complete water meter or calculator or measurement transducer; | | | |
| 7.2.9.1 c) | a list of the parts with a description of their constituent materials when these parts have a metrological influence; | | | |
| 7.2.9.1 d) | an assembly drawing with identification of the different parts; | | | |
| 7.2.9.1 e) | for meters fitted with correction devices, a description of how the correction parameters are determined; | | | |
| 7.2.9.1 f) | a drawing showing the location of seals and verification mark(s); | | | |
| 7.2.9.1 g) | a drawing of regulatory markings; | | | |
| 7.2.9.1 h) | for combination meters that comprise approved meters, the test reports for those meters; | | | |
| 7.2.9.1 i) | optionally, a user guide and installation manual. | | | |
| 7.2.9.2 | In addition, the application for type approval of a water meter with electronic devices shall include: | | | |
| 7.2.9.2 a) | a functional description of the various electronic devices; | | | |
| 7.2.9.2 b) | a flow diagram of the logic, showing the functions of the electronic devices; | | | |
| 7.2.9.2 c) | any document or evidence which shows that the design and construction of the water meter with electronic devices comply with the requirements of | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | this part of OIML R 49-1, in particular OIML R 49-1:2024, 5.1 and Annex B. | | | |
| 7.2.9.3 | The applicant seeking type approval shall provide the body responsible for the evaluation with a meter or a calculator (including indicating device) or a measurement transducer which is representative of the final type, in addition to the samples provided as per 7.2.2. | | | |
| | | | | |

## 3.3 Performance tests for electronic water meters and electronic devices fitted to mechanical meters

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Dry heat** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 4.2 under conditions of high temperature.<br><br>(see OIML R 49-2:2024, 8.2) | | | |
| **Cold** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 4.2 under conditions of low temperature.<br><br>(see OIML R 49-2:2024, 8.3) | | | |
| **Damp heat, cyclic, condensation** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of high humidity when combined with cyclic temperature changes.<br><br>Cyclic tests shall be applied in all the cases where condensation is important or when the penetration of vapour is accelerated by the breathing effect.<br><br>(see OIML R 49-2:2024, 8.4) | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Power voltage variation, for water meters powered by DC batteries and DC mains** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 4.2 under conditions of varying DC voltage (if relevant).<br><br>(see OIML R 49-2:2024, 8.5) | | | |
| **Replaceable battery** | | | | |
| 5.2.4 | To verify compliance with the provisions in OIML R 49-1, 5.2.4.3. The properties and parameters of the meter shall not be affected by the interruption of the electrical supply when the battery is replaced.<br><br>(see OIML R 49-2:2024, 8.5) | | | |
| **Power voltage variation, for water meters powered by direct AC or by AC/DC converters** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 4.2 under conditions of varying AC mains power voltage (if relevant).<br><br>(see OIML R 49-2:2024, 8.5) | | | |
| **Vibration (random)** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of random vibration.<br><br>(see OIML R 49-2:2024, 8.6) | | | |
| **Mechanical shock** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of mechanical shocks.<br><br>(see OIML R 49-2:2024, 8.7) | | | |
| **Short time power reductions** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of short time mains voltage reductions.<br><br>(see OIML R 49-2:2024, 8.8) | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| **Bursts** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions where electrical bursts are superimposed on input/output and communication ports.<br><br>(see OIML R 49-2:2024, 8.9) | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions where electrical bursts are superimposed on the mains voltage.<br><br>(see OIML R 49-2:2024, 8.10) | | | |
| **Electrostatic discharge** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of direct and indirect electrostatic discharges.<br><br>(see OIML R 49-2:2024, 8.11) | | | |
| **Electromagnetic susceptibility — electromagnetic fields** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of radiated electromagnetic fields.<br><br>(see OIML R 49-2:2024, 8.12) | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of conducted electromagnetic fields.<br><br>(see OIML R 49-2:2024, 8.18) | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions of mains power frequency electromagnetic field test.<br><br>(see OIML R 49-2:2024, 8.13) | | | |
| **Surges on signal, data, and control lines** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions where electrical | | | |

| OIML R 49-1:2024, subclause | **Requirement** | + | − | **Remarks** |
|---|---|---|---|---|
| | surges are superimposed on I/O and communication ports.<br><br>(see OIML R 49-2:2024, 8.14) | | | |
| **Surges on AC and DC mains power lines** | | | | |
| A.5 | To verify compliance with the provisions in OIML R 49-1, 5.1.1 under conditions where electrical surges are superimposed on the mains voltage.<br><br>(see OIML R 49-2:2024, 8.15) | | | |
| | | | | |

Use this page to detail remarks from the checklist.