**DRAFT ORDER AMENDING ORDER ICT/155/2020 OF 7 FEBRUARY 2020 REGULATING STATE METROLOGICAL CONTROL OF CERTAIN MEASURING INSTRUMENTS.**

Order ICT/155/2020 of 7 February 2020 regulating State metrological control of certain measuring instruments implements, for certain measuring instruments, the provisions of Royal Decree 244/2016 of 3 June 2016 implementing Law 32/2014 of 22 December 2014 on Metrology concerning State metrological control, at its various phases, depending on the type of instrument: conformity assessment, periodic verification and verification after modification or repair.

This Order consists of a sole article, which amends Order ICT/155/2020 of 7 February 2020 to improve the implementation of State metrological control, and two final provisions.

Since the adoption of Order ICT/155/2020 of 7 February 2020, it has been apparent, on the one hand, that certain aspects of the Order need to be amended to make it more applicable and that errors identified need to be corrected and, on the other hand, that there is a need to repeal Order ITC/3721/2006 of 22 November 2006 regulating State metrological control at the phase of bringing to market and putting into service of working instruments known as manometers, compound gauges and vacuum gauges with elastic receptor elements and direct indications that are intended to measure pressure, due to the failure to implement it since its publication. It is also necessary to amend Annex VI of Order ICT/155/2020 of 7 February 2020 to establish metrological control of measuring systems in tankers for the supply of cryogenic liquids with a boiling point below – 153 °C, for the supply of liquefied carbon dioxide and of liquefied natural gas (LNG), and to include two new annexes in that Order to establish State metrological control of charging stations for electric vehicles and instruments for measuring the number of particles (PN) emitted by vehicles equipped with compression ignition engines.

The objective of this Order is, therefore, to amend various parts of Order ICT/155/2020 of 7 February 2020 to better understand and adapt to the needs that have been expressed since its publication; repeal Order ITC/3721/2006 of 22 November 2006 regulating State metrological control at the phase of bringing to market and putting into service of working instruments known as manometers, compound gauges and vacuum gauges with elastic receptor elements and direct indications that are intended to measure pressure; regulate measuring systems in tankers for the supply of cryogenic liquids with a boiling point below – 153 °C, for the supply of liquefied carbon dioxide and of LNG; and establish State metrological control of charging stations for electric vehicles and instruments for measuring the number of particles (PN) emitted by vehicles equipped with compression ignition engines.

This Order meets the principles of sound regulation under which public authorities shall act in exercising legislative initiative and regulatory powers, such as the principles of necessity, effectiveness, proportionality, legal certainty, transparency and efficiency, provided for in Article 129 of Law 39/2015 of 1 October 2015 on the common administrative procedure of public administrations. It thus demonstrates compliance with the principles of necessity and effectiveness given the general interest on which its content is based, since the regulation seeks to respond to new needs that have arisen since its publication. The regulation is also in accordance with the principle of proportionality, since it contains the material provisions to

achieve the aforementioned objectives. It also complies with the principle of legal certainty, since the regulation is consistent with the rest of the legal system and is intended to be clear and to facilitate action and decision-making by the persons and bodies involved in State metrological control. With regard to the principle of transparency, this Order has been subject to a public hearing and information procedure for the persons and entities concerned, in accordance with Article 26(6) of Government Law 50/1997 of 27 November 1997. With regard to the principle of efficiency, no administrative burden is created, since it is an amendment to an order already in force. In addition, regarding public expenditure, it should be noted that the budgetary impact is zero and that the principles of budgetary stability and financial sustainability have not been compromised.

The Autonomous Communities have been consulted to draw up this Order. The High Council of Metrology also gave a favourable opinion, in accordance with Article 2(1)(h) of Royal Decree 584/2006 of 12 May 2006 determining the structure, composition and functioning of the High Council of Metrology.

This Order has been approved in advance by the Ministry for Digital Transformation and Public Service, in accordance with the fifth paragraph of Article 26(5) of Law 50/1997 of 27 November 1997.

This Order has also undergone the procedure for the provision of information in the field of technical standards and regulations on information society services, as laid down by Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services, as well as by Royal Decree 1337/1999 of 31 July 1999, which transposes these Directives into Spanish law.

In view of the above, and in accordance with the second final provision of Royal Decree 244/2016 of 3 June 2016, I hereby decree:

**Sole article.** *Amendment of Order ICT/155/2020 of 7 February 2020 regulating State metrological control of certain measuring instruments***.**

Order ICT/155/2020 of 7 February 2020 regulating State metrological control of certain measuring instruments is amended as follows:

One. Article 9(a) is amended to read as follows:

> '(a) Administrative examination:
>
> 1. The administrative examination consists of the complete identification of the measuring instrument and verification that the measuring instrument meets the requirements for being lawfully in service. The examination shall be carried out on the basis of the information provided by the applicant in the verification request set out in Annex XIX. The examination shall also include checking that the measuring instrument has the seals at the location stated in its conformity assessment or equivalent procedure and that it has a name plate and the metrological markings established in law. Where electronic seals are available on the measuring instrument, it shall be

verified that they have not been tampered with and their validity shall be recorded in the certificate of verification issued.

2. If the approved metrological verification body finds that the sealing carried out by the instrument manufacturer or by a repairer does not fulfil its function even though it has been affixed in the position and manner set out in the relevant conformity assessment procedure, it shall inform the competent public authority of this, electronically and within a maximum of three days, so this authority may take the measures it deems appropriate.

3. If, during the administrative examination, the approved metrological verification body detects non-compliance with the requirements that measuring instruments shall meet to be lawfully in service, it shall immediately inform the holder of the measuring instrument. The existence of such non-compliances shall not interrupt carrying out of the verification check requested.

4. The approved metrological verification body shall immediately inform the competent public authority of any evidence of fraudulent tampering with the measuring instrument that it may have detected.

5. The approved metrological verification body shall check that the accessible seals affixed during repair or modification by the repairer comply with the provisions of Section 4(a) of Annex III to Royal Decree 244/2016 of 3 June 2016.'

Two. Article 11(2) is amended to read as follows:

'2. The approved metrological verification body that carried out the verification shall seal the instrument while maintaining the seals affixed by the repairer as a result of their actions and shall issue the corresponding certificate of verification within a maximum of 10 days. The identity and location of all accessible seals, including electronic seals, shall be noted on the certificate of verification and indication made as to whether the verification was a verification after repair or a verification after modification.'

Three. Article 12 is amended to read as follows:

'Article 12. *Failed verifications.*

Where a measuring instrument does not pass the verification after repair or modification, the approved metrological verification body shall affix the service disqualification label, in accordance with Article 5 of Annex III to Royal Decree 244/2016 of 3 June 2016, specifying the type of measuring instrument in question. It shall also issue an unfavourable verification report within a maximum of five days, specifying the specific reasons for the failed verification, and give electronic notice of the failure, within the same period, to the competent public authority. The measuring instrument may not be used for the purposes set out in Article 8(1) of Law 32/2014 of 22 December 2014 until the fault has been remedied and a re-verification has been

requested following repair These instruments shall, where applicable, be subject to the provisions of Article 8 of this Order.'

Four. Article 14(1) is amended to read as follows:

'1. At least one month before the end of the period set out in the Annex for each measuring instrument, the holder of the measuring instrument shall apply for verification to an approved metrological verification body or, where appropriate, to the competent public authority acting as a body. This request shall be made electronically and shall contain the data set out in Annex XIX.

After the time limit for a measuring instrument to be subjected to periodic verification, it may not be used for the purposes laid down in Article 8(1) of Law 32/2014 of 22 December 2014 until it passes this verification.'

Five. Paragraph 4 is amended and a new paragraph 5 is added to Article 15(a) to read as follows:

'(a) Administrative examination:

1. The administrative examination consists of the complete identification of the measuring instrument and verification that the measuring instrument meets the requirements for being lawfully in service. The examination shall be carried out on the basis of the information provided by the applicant in the request for verification set out in Annex XIX to this Order. The examination shall also include checking that the measuring instrument has the seals at the location stated in its conformity assessment or equivalent procedure and that it has a name plate and the metrological markings established in law. Where electronic seals are available on the measuring instrument, it shall be verified that they have not been tampered with and their validity shall be recorded in the certificate of verification issued.

2. If the approved metrological verification body finds that the sealing carried out by the instrument manufacturer or by a repairer does not fulfil its function even though it has been affixed in the position and manner set out in the relevant conformity assessment procedure, it shall inform the competent public authority of this, electronically and within a maximum period of three days, so this authority may take the measures it deems appropriate.

3. If, during the administrative examination, the approved metrological verification body detects non-compliance with the requirements that measuring instruments shall meet to be lawfully in service, it shall immediately inform the holder of the measuring instrument. The existence of such non-compliances shall not interrupt carrying out of the verification check requested.

4. The approved metrological verification body shall immediately inform the competent public authority of any evidence of fraudulent tampering with the measuring instrument that it may have detected.

5. The approved metrological verification body shall check that the accessible seals of the instrument comply with its conformity assessment or with what is stated in its most recent certificate of verification, as appropriate.'

Six. Article 17(2) is amended to read as follows:

'2. The approved metrological verification body that carried out the verification shall issue a corresponding certificate of verification within a maximum of 10 days. The identity and location of all accessible seals, including electronic seals, shall be noted in the certificate of verification.'

Seven. Article 18 is amended to read as follows:

'Article 18. *Failed verifications.*

Where a measuring instrument does not pass the periodic verification, the approved metrological verification body shall affix the service disqualification label, in accordance with Article 5 of Annex III to Royal Decree 244/2016 of 3 June 2016, specifying the type of measuring instrument in question. It shall also issue an unfavourable verification report within a maximum of five days, specifying the specific reasons for the failed verification, and give electronic notice of the failure, within the same period, to the competent public authority. The measuring instrument may not be used for the purposes stipulated in Article 8(1) of Law 32/2014 of 22 December 2014 until the fault has been remedied and a re-verification has been requested following repair. These instruments shall, where applicable, be subject to the provisions of Article 8 of this Order.'

Eight. Paragraph 4 is added to Article 19, as follows:

'4. Notwithstanding the provisions of paragraph 3, where an instrument has a procedure set out in its relevant Annex to increase its useful life, and exceeds it, the maximum permissible errors in the extended period shall be those set out in that procedure.'

Nine. Annex III is amended to read as follows:

‘**ANNEX III**

Water meters

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of water meters, which means instruments intended for measuring water volumes in closed full-section pipes, identifying for the purposes of its application, irrespective of the technology they use, the following:

(a) those intended for measuring clean, cold or hot water, for residential, commercial or light industrial use, hereinafter, clean water meters;

(b) those intended for the measurement of cold water specifically used for the management of public water, irrigation or any other public use, excluding those defined under (a) above, hereinafter, water meters for other uses.

To apply this Annex, a managing body, hereinafter, manager, is defined as the owner of a number of water meters and this manager shall submit these meters to the metrological control established in this Order.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service clean water meters is set out in Annex VIII to Royal Decree 244/2016 of 3 June 2016.

The applicable conformity assessment phase for bringing to market and putting into service water meters for other uses is set out in Chapter II of this Order.

Water meters for other uses shall meet the common essential requirements of the applicable measuring instruments in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I of this Annex, and compliance with this shall be established through the technical testing procedure set out in Appendix II to this Annex.

The modules to be used to carry out the conformity assessment of water meters for other uses shall be chosen by the manufacturer from among the following options:

(a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;

(b) Module B, type examination, plus Module F, type conformity based on instrument verification;

(c) Module H1, conformity based on full quality assurance plus design examination.

Section 4. *Useful life of clean water meters*

1. In accordance with Article 8(3) of Law 32/2014 of 22 December 2014, implemented by Article 16(2) of Royal Decree 244/2016 of 3 June 2016, the useful life of clean water meters shall be 12 years.

2. These meters shall not be subject to periodic verification.

3. The repair or modification of these meters is prohibited.

4. The useful life may be extended by successive periods of five years if the manager shows that, by applying the verification criteria set out in Appendix III to this Annex, the water meters comply with the requirements of this Annex. Verification shall be carried out by an approved metrological verification body.

5. Where the owner of the water meter is the consumer, they may choose to delegate to the manager the actions, operations and procedures related to the requirements on the useful life set out in this point; and they shall agree to this and sign a document to this end that shall be filed by the manager. If this delegation is not carried out, the manager shall inform the public authority responsible for water in its territorial area, which shall set out the guidelines for action.

Notwithstanding the provisions of points 1, 2 and 3 of this section, clean water meters with a permanent flow $Q_3 \geq 63$ $m^3/h$ shall be eligible for verification in accordance with Sections 5 and 6 of this Annex.

Section 5. *Verification after repair or modification* for water meters for other uses.

Verification after repair or modification of water meters for other uses shall be carried out in accordance with Chapter III of this Order and Appendix IV to this Annex.

Section 6. Periodic verification of water meters for other uses.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix IV to this Annex.

The period of time in years between the meter being put into service and the first verification taking place shall be 12 years and, for subsequent verifications, it shall be five years following the last verification.

## APPENDIX I
## **Specific essential requirements for water meters for other uses**

The definitions given in Article 2 of Annex VIII to Royal Decree 244/2016 of 3 June 2016 and the terminology used in the International Vocabulary of Terms in Legal Metrology apply to water meters for other uses.

1. General requirements.

1.1 Rated operating conditions. The manufacturer shall specify the rated operating conditions applicable to the instrument and specifically those detailed below.

1.1.1 Water flow rate range. The water flow rate shall comply with the following conditions:

$Q_3 / Q_1 \geq 40$

$Q_2 / Q_1 = 1.6$

$Q_4 / Q_3 = 1.25$

1.1.2 Water temperature range. The water temperature shall comply with the following condition: from 0.1 °C to 30 °C.

1.1.3 Water relative pressure range. This shall be 30 kPa (0.3 bar) to at least 1 MPa (10 bar) to $Q_3$.

1.1.4 For water meters for other uses with power supply, the nominal value of the AC supply voltage and/or the limits of the DC supply.

1.2 Maximum permissible errors.

1.2.1 The maximum permissible positive or negative error on volumes delivered under flow rates ($Q$) within the transition flow rate ($Q_2$) and overload flow rate ($Q_4$) is 2 % ($Q_2 \leq Q \leq Q_4$).

1.2.2 The maximum permissible positive or negative error on volumes delivered under flow rates ($Q$) within the minimum flow rate ($Q_1$) and transition flow rate ($Q_2$) is 5 % ($Q_1 \leq Q < Q_2$).

1.3 Electromagnetic immunity for meters incorporating electronic devices.

1.3.1 The effect of electromagnetic interference on a water meter for other uses shall be such that:

– the change in the measurement result is no greater than the critical variation value set out in point 1.3.3, or

– the indication of the measurement result is such that it cannot be interpreted as a valid result, such as a momentary variation that cannot be interpreted, memorised or transmitted as a result of the measurement.

1.3.2 After experiencing electromagnetic interference, the water meter shall:

– recover its capacity to operate within the maximum permissible error;

– retain all measurement functions in good working order;

- allow recovery of all measurement data present just before the interference arose.

1.3.3 The critical variation value is the lower of the following two values:

– 1 % of the measured volume;

– 2 % of the volume corresponding to one minute of operation at the permanent water flow rate ($Q_3$).

1.4 Durability. After the test set out in point 5 of Appendix II to this Annex has been carried out, the criteria listed below shall be met.

1.4.1 The difference between the measurement result after the durability test and the initial measurement result shall not exceed:

– 3 % of the measured volume between $Q_1$ (included) and $Q_2$ (excluded);

– 1.5 % of the measured volume between $Q_2$ (included) and $Q_4$ (included).

1.4.2 The absolute value of the measured volume indication error after the durability test shall not exceed:

– 6 % of the measured volume between $Q_1$ (included) and $Q_2$ (excluded);

– 2.5 % of the measured volume between $Q_2$ (included) and $Q_4$ (included).

1.5 Suitability.

1.5.1 Where the water meter for other uses incorporates moving elements that could alter the water velocity distribution in the sensing element environment, and its function is not related to the metrology of the sensing element, it shall be verified that regardless of the position of the moving element, the relative indication errors do not exceed the requirements of point 1.2 of this Appendix. This check shall be carried out for a sufficient number of moving element positions to be able to ensure the preceding condition is met.

1.5.2 The metrological specifications of a water meter for other uses shall not be altered beyond the maximum permissible error by connection to another device, by any feature of the connected device or by any device communicating remotely with the measuring instrument.

1.5.3 The water meter for other uses shall be able to operate in any position in which it is installed, unless clearly stated otherwise.

1.5.4 The manufacturer shall specify whether the water meter for other uses is designed to measure reverse flow. In this event, the reverse flow volume shall either be subtracted from the accumulated volume or recorded separately. The same maximum permissible error shall apply to both forward and reverse flow.

Water meters for other uses that are not designed to measure reverse flow shall either prevent reverse flow or resist an accidental reverse flow without their metrological properties altering or deteriorating.

1.5.5 The following information shall appear on the meter:

i. unit of measurement: cubic metre;

(ii) numerical value of $Q_3$;

(iii) the ratio $Q_3/Q_1$ preceded by the letter R, for vertical or horizontal positions;

(iv) maximum allowable pressure when different from 1 MPa;

(v) direction of flow (shown on both sides of the casing or on a single side that shows the direction of flow using an arrow that shall be clearly visible under all circumstances);

vi. the letter V or H, if the meter can operate only in the vertical or horizontal position with the ratio set out in point (iii);

(vii) maximum pressure loss, if different from 63 kPa;

(viii) manufacturer's name or mark;

(ix) year of manufacture (at least the last two digits) and a serial number (as close as possible to the indicating device);

(x) conformity marking;

(xi) severity level of the climatic and mechanical environment;

(xii) electromagnetic environment class, if any;

(xiii) information on the installation conditions declared by the manufacturer.

The information in the last three points can be provided in a separate document that is unambiguously linked to the meter by means of a unique identifier.

Depending on the type of power supply the following requirements may apply.

(a) If the power supply is internal: whether the internal power supply is replaceable or fixed, the date by which it has to be replaced shall be given on the water meter for other uses.

(b) If the power supply is external: the expiry date (at least the year) of the internal power supply under standby conditions and the voltage–frequency of the external power supply shall be given on the water meter for other uses. In the event of external power failure, the internal power supply shall electrically power the instrument for at least one month.

1.5.6 Water meters for other uses, irrespective of their technology, may be designed to provide physical or electrical signals that allow remote reading via an appropriate internal or external system while ensuring that the signals coincide with what the meter itself is indicating.

1.5.7 Water meters for other uses with digital electronic indication technology may allow the reading, by means of communications, of digital information including:

i. measured volumes;

(ii) alarms and events;

(iii) meter identification data.

1.6 The competent public authorities shall ensure that the properties (pressure, temperature and flow rates) are determined by the public utility or by the person legally authorised to install the water meter for other uses in a way that is appropriate to accurately measure the expected or foreseeable consumption.

## APPENDIX II
## **Technical test procedure for conformity assessment of water meters for other uses**

The tests shall be carried out, in general, in accordance with the normative documents in force: Recommendation OIML R 49-1 “Water meters for cold potable and hot water. Part 1: Metrological and technical requirements” and Recommendation OIML R 49-2. “Water meters for cold potable and hot water. Part 2: Test methods”, or harmonised standards, except for tests where other conditions are expressly stated.

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

Prior to carrying out the conformity assessment tests, each model of water meter for other uses submitted shall be externally inspected to ensure that it complies with the relevant provisions of the normative documents mentioned above.

(a) Design conformity assessment.

1. Objective of the conformity assessment. The tests carried out during the conformity assessment process are intended to verify that the water meters for other uses of the type for which conformity is sought comply with the requirements set out in this Annex. No changes to the water meter for other uses are allowed during the conformity assessment tests. If modifications are made, all previously completed tests shall be repeated.

2. Number of water meters for other uses to be tested. Water meters for other uses shall be randomly selected from among those supplied by the applicant. The number of meters to be tested shall be as stated in the version of Recommendation OIML R 49-2 in force at the time of testing.

In the case of a conformity assessment of families of water meters for other uses, the requirements stated in the version of Recommendation OIML R 49-2 in force at the time of testing shall be followed.

3. Compliance. A type of water meter for other uses will comply with the requirements of this Annex if the result of each of the tests is satisfactory.

4. Group testing of water meters for other uses. Water meters for other uses can be tested individually or in groups. In the latter case, the individual specifications of these meters shall be accurately determined. Any interaction between water meters for other uses and test benches shall be eliminated.

When water meters for other uses are tested in series, the pressure at the outlet of each meter shall be sufficient to prevent cavitation.

5. Tests to be carried out. The tests to be carried out for the conformity assessment of water meters for other uses are listed below.

– Static pressure test.

– Accuracy tests: determination of intrinsic indication errors under reference conditions.

– Accuracy tests: meters with electronic devices shall be tested under the effect of influence factors or disturbances as specified in the recommendation.

– Identification of intrinsic errors (of indication).

– Absence of flow test.

– Water pressure test.

– Verification of flow profile sensitivity classes.

– Tests on the ancillary devices of the meter.

– Pressure loss tests.

– Reverse flow tests.

– Durability tests.

– Resistance to solid particles test in accordance with the version of UNE-ISO 16399 “Meters for irrigation water (Class A)”, in force at the time of testing.

– Static magnetic field immunity test.

(b) Conformity assessment for putting into service. The conformity assessment for putting into service shall be carried out in accordance with the version of Recommendation OIML R 49-1 in force at the time of testing.

APPENDIX III

**Technical verification test procedure to increase the useful life of water meters**

The verification procedure for a water meter shall be in accordance with this Appendix.

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

Verification may be carried out either by unit or by statistical sampling, bearing in mind that, for the purposes of this Order, the holder required to verify a water meter is:

(a) in the case of verification by unit, the owner of the instrument;

(b) in the case of verification by statistical sampling, the manager.

1. Verification by statistical sampling.

1.1 To be able to apply verification by statistical sampling, it is the responsibility of the manager to group the water meters subject to this verification into homogeneous lots.

1.2 All the instruments that form part of a verified lot are deemed to have the same verification test results.

1.3 The manager may submit lots of instruments for verification by statistical sampling after informing the approved metrological verification body or the competent public authority of the identification of the instruments that make up each of the lots created.

1.4 If the verified lot does not meet the requirements established, the manager shall take the necessary measures to prevent the lot remaining in service.

1.5 Where the manager is not the holder of all or part of a lot, the manager shall agree with the holder to include the instruments in a lot.

1.6 The manager who has constituted the lot shall inform the competent public authority of any changes to the lot that could call its constitution into question. A change to a lot leads to a new lot being formed. If the batch has not been changed during the period of validity of the verification, the manager shall inform the approved metrological verification body or the competent public authority of the next verification at least three months before this verification takes place.

2. Criteria for the formation and delimitation of a lot. Only water meters that meet the following minimum requirements may be included in a lot:

(a) the same year of manufacture;

(b) the same permanent flow rate ($Q_3$);

(c) the same ratio between permanent flow rate and minimum flow rate ($Q_3/Q_1$);

(d) the same nominal diameter (DN);

(e) the same meter mark and model;

f) the same operational/supply conditions;

(g) in the case of water meters commissioned in accordance with the Order of 28 December 1988 regulating cold water meters, in addition to the above, except as provided for in points (b) and (c), the meters shall have the same metrological class and the same nominal flow rate. $Q_N$.

2.1 Once the lot has been established, the representative sample of the lot shall be maintained for all subsequent verifications based on sampling verifications. Each water meter can be selected for only one lot.

2.2 For implementation of the verification by statistical sampling of water meters, the following information shall be provided:

(a) permanent flow rate ($Q_3$);

(b) the ratio between permanent flow rate and minimum flow rate ($Q_3/Q_1$);

(c) nominal diameter (DN);

(d) identification of type or model;

(e) manufacturer;

f) metrological marking;

(g) date of commissioning or of the last verification;

(h) lot size;

(i) public utility entity that owns the water meters;

(j) declaration of the company or public utility entity as to whether the lot for which the verification by sampling applies has previously undergone verification by sampling;

(k) date on which the water meters selected for verification by sampling are expected to be removed from the network and made available for verification;

(l) chosen sampling plan;

(m) in the case of water meters commissioned in accordance with the Order of 28 December 1988 regulating cold water meters, in addition to the provisions above, with the exception of the provisions of points (a) and (b), the metrological class and the nominal flow rate $Q_n$ shall be provided.

2.3 Selection and processing of the water meters in the sample. Before carrying out the tests, the approved metrological verification body and the applicant shall agree on the following:

(a) procedure and specifications for the random sampling of water meters (e.g. by manufacturer's serial number, by holder, using a table of random numbers or a program for computer-assisted generation of random numbers) to ensure that the sample is random and representative of the lot;

(b) sampling plan to be applied;

(c) date or period for removing the water meters that comprise the sample from the network, date of their delivery to the verification body, place and period of verification between the two operations and date of verification of the meters tested; and

(d) procedure to reduce the possibility of inadmissible interventions in the water meters that comprise the sample during the period between their removal from the network and verification.

2.4 The period between removal of the water meters from the supply network and their verification shall be as short as possible and, in any event, it shall not exceed one month.

2.5 The water meters shall be protected against drying out. They shall be removed from the network in such a way as to keep as much water as possible inside them.

2.6 No intervention such as repair, adjustment, meter change, etc. is allowed, except rinsing the water meters.

2.7 Depending on the size of the lot and the sampling plan chosen, the water meters in the sample and the spare water meters shall be selected from the defined lot. The selection shall be made according to the rules of mathematical statistics, i.e. the probability of being selected as a sample water meter or as a spare water meter shall be the same for each water meter in the lot.

2.8 Non-compliant water meter. A meter that is part of the sample shall be considered non-compliant if it does not comply with the specifications of the conformity assessment certificate or if it does not comply with the verification requirements.

2.9 Spare water meters.

(a) If the selected sample water meters include meters that:

(i) show external damage;

(ii) have broken seals;

(iii) cannot be located;

(iv) have been incorrectly submitted;

replacement of such meters with spare water meters is permitted before the verification process starts.

(b) The actual number of water meters that can be replaced by spare water meters depends on the size of the lot and is set out in this Appendix.

(c) There shall be only one replacement period, immediately after the visual examination. Spare water meters used for replacement shall be randomly chosen from the lots formed.

(d) If it is not possible to complete the whole sample in accordance with the above provisions, the request for verification by statistical sampling shall be rejected.

2.10 Retention period. The approved metrological verification body or competent public authority may set a time limit until which the sample of water meters shall remain unchanged. This period shall not exceed one month from the date of verification by statistical sampling to the date of possible verification.

2.11 Sampling plan. The sampling plans applicable to verification by statistical sampling are set out in point 3 of this Appendix.

From a statistical point of view, the sampling plans set out in Table 1 and Table 2 of this Appendix are equivalent to each other and binding on the body performing the verifications. For lots of more than 35 000 units, the tables in point 3 of this Appendix may be extended in accordance with ISO Standard 2859-2. “Sampling procedures for inspection by attributes. Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection”, in force.

To obtain a higher probability of acceptance of lot sizes, a sampling plan may be chosen that is applicable to larger lot sizes with a correspondingly larger sample size.

Changing the sampling plan originally chosen to another after the verification has started is not allowed.

2.12 Verification result. The lot shall be accepted if the sampling plan requirements have been met. Even if the lot is declared compliant, water meters in the sample that do not comply with the requirements shall be taken out of service.

If the lot is rejected, all the units in the lot shall be immediately taken out of service.

If the lot is accepted after verification by statistical sampling has been carried out in accordance with one of the sampling plans set out in point 3 of this Appendix, the water meters that form part of the lot may remain in service for the five-year period set out in point 4.4 of this Annex.

The competent public authority shall be informed of the result of the verification by statistical sampling. The approved metrological verification body shall provide the results of the verification if these are requested by the competent public authority.

2.13 Verification label. The verification label established in Article 17 of this Order shall be affixed only to the compliant water meters in the representative sample of the lot verified. For the other water meters belonging to the lot verified, the manager shall inform the holders of those instruments of the extension of their useful life.

3. Sampling plans. Verification by statistical sampling of lots may be carried out based on one of the sampling plans described below.

Table 1. Verification by single sampling

| Lot size | Sample size | Number of non-compliant meters | | Spare meters |
|---|---|---|---|---|
| | | Lot acceptance | Lot rejection | |
| 0 to 1 200 | 50 | 1 | 2 | 10 |
| 1 201 to 3 200 | 80 | 3 | 4 | 16 |
| 3 201 to 10 000 | 125 | 5 | 6 | 25 |
| 10 001 to 35 000 | 200 | 10 | 11 | 40 |

Table 2. Verification by double sampling

| Lot size | Sample | Sample size | Cumulative sample size | Nunber of non-compliant meters | | | Spare meters |
|---|---|---|---|---|---|---|---|
| | | | | Lot acceptance | Lot rejection | Need for 2nd sample | |
| 0 to 1 200 | First | 32 | 32 | 0 | 2 | 1 | 6 |
| | Second | 32 | 64 | 1 | 2 | | 6 |
| 1 201 to 3 200 | First | 50 | 50 | 1 | 4 | 2 to 3 | 10 |
| | Second | 50 | 100 | 4 | 5 | | 10 |
| 3 201 to 10 000 | First | 80 | 80 | 2 | 5 | 3 to 4 | 16 |
| | Second | 80 | 160 | 6 | 7 | | 16 |
| 10 001 to 35 000 | First | 125 | 125 | 5 | 9 | 6 to 8 | 25 |
| | Second | 125 | 250 | 12 | 13 | | 25 |

In each row corresponding to a second sample, the number of non-compliant meters refers to the cumulative sample size.

The installation of the meter shall be in accordance with the technical requirements for use provided by the manufacturer so that the metrological specifications of the meter will not be affected by any external element and do not distort the water flow.

4. Metrological examination.

4.1 General test requirements.

(i) Tests performed on test bench. During the tests, there shall be no leakage, drainage or entry into the installation between the meter being tested and the calibrated reference device.

The maximum permissible variation in the instantaneous average flow rate during testing (excluding start-up and shut-down), for the prescribed flow rate shall not exceed ± 2.5 % for the minimum flow rate (between $Q_1$ and $Q_2$ excluded) and ± 5 % for transition flow rates (between $Q_2$ and $Q_4$).

The meter shall be installed in accordance with the manufacturer's instructions with respect to straight upstream/downstream pipe runs or the existence of a flow calming device. Water meters of the same model and size may be installed in series provided that the pressure at the outlet of all the meters is sufficient to ensure that there are no disturbances in their operation or interference between the meters.

(ii) Tests carried out without disassembling the meter. It is necessary to add a calibrated reference device to the circuit in which the meter to be verified is installed. The installation of this calibrated reference device shall comply with the manufacturer’s instructions.

4.2 Expanded uncertainty in the volume of water measured. The verification procedure implemented in a particular test facility shall comply with the requirement that the expanded uncertainty, with a coverage factor equal to 2, in the estimation of the volume of water passing through the meter shall not exceed 1/3 of the maximum permissible error in point 1.2 of Appendix I to this Annex.

4.3 Test volumes. The test volumes shall be such that they comply with the provisions of point 4.2 of this Appendix.

The minimum volume of water used in any given continuous test at any given flow rate shall be selected so that it is at least equal to the greater of the following values:

– the volume corresponding to one minute of operation of the meter at the corresponding flow rate;

– 200 times the value of the verification scale interval of the meter to be tested.

Smaller minimum test volumes may be accepted provided it can be proven that they comply with the requirement set out in point 4.2 of this Appendix.

4.4 Tests to be carried out. The tests shall be carried out on the following flows: zero, permanent or nominal, transitional and minimum so that the non-zero average flow rate during the test falls, respectively:

(a) between $Q_3$ and 1.25 $Q_3$ (permanent flow rate);

(b) between $Q_2$ and 1.1 $Q_2$;

(c) between $Q_1$ and 1.1 $Q_1$.

5. Maximum permissible errors. In determining the error in the indicated volume, the relevant corrections shall be applied to the readings based on the errors specified in the calibration certificates of the standard instruments.

The maximum permissible relative errors in the volume indicated by the meter under test for the established test flow rate are set out below.

– For $Q_3$ and $Q_2$: ± 4 %.

– For $Q_1$: ± 10 %.

– For zero flow rate: 0 %.

Where all errors are of the same sign, at least one error shall be less than half of the maximum permissible error.

6. References to water flow rates of commissioned meters in accordance with the Order of 28 December 1988. References that, in the preceding points of this Appendix, mention flow rates $Q_4$, $Q_3$, $Q_2$ and $Q_1$ shall be understood to be made at flow rates $Q_{max}$, $Q_n$, $Q_t$ and $Q_{min}$ respectively, in accordance with the Order of 28 December 1988.

## APPENDIX IV

**Technical test procedure for verification after repair and modification and periodic verification of water meters.**

The procedure for verification after repair or modification and for periodic verification for a water meter shall consist of the procedures and actions set out below.

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this

Order. For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

2. Metrological examination.

2.1 General test requirements.

(i) Tests performed on test bench. During the tests, there shall be no leakage, drainage or entry into the installation between the meter being tested and the calibrated reference device.

The maximum permissible variation in the instantaneous average flow rate during testing (excluding start-up and shut-down), for the prescribed flow rate shall not exceed ± 2.5 % for the minimum flow rate (between $Q_1$ and $Q_2$ excluded) and ± 5 % for transitional flow rates (between $Q_2$ and $Q_4$).

The meter shall be installed in accordance with the manufacturer's instructions with respect to straight upstream/downstream pipe runs or the existence of a flow stabiliser. Water meters of the same model and size may be installed in series provided that the pressure at the outlet of all the meters is sufficient to ensure that there are no disturbances in their operation or interference between the meters.

(ii) Tests carried out without disassembling the meter. It is necessary to add a calibrated reference device to the circuit in which the meter to be verified is installed. The installation of this calibrated reference device shall comply with the manufacturer's instructions.

2.2 Expanded uncertainty in the volume of water measured. The verification procedure implemented in a particular test facility shall comply with the requirement that the expanded uncertainty, with a coverage factor equal to 2, in the estimation of the volume of water passing through the meter shall not exceed 1/3 of the maximum permissible error in point 1.2 of Appendix I to this Annex.

2.3 Test volumes. The test volumes shall be such that they comply with the provisions of point 2.2 of this Appendix. The minimum volume of water used in any given continuous test at any given flow rate shall be selected so that it is at least equal to the greater of the following values:

– the volume corresponding to one minute of operation of the meter at the corresponding flow rate;

– 200 times the value of the verification scale interval of the meter to be tested.

Smaller minimum test volumes may be accepted provided it can be proven that they comply with the requirement set out in point 2.2 of this Appendix.

2.4 Tests to be carried out. The tests shall be carried out on the following flows: zero, permanent or nominal, transitional and minimum so that the non-zero average flow rate during the test falls, respectively:

(a) between $Q_3$ and 1.25 $Q_3$(permanent flow rate);

(b) between $Q_2$ and 1.1 $Q_2$;

(c) between $Q_1$ and 1.1 $Q_1$.

3. Maximum permissible errors. In determining the error in the indicated volume, the relevant corrections shall be applied to the readings based on the errors specified in the calibration certificates of the standard instruments.

The maximum permissible relative errors in the volume indicated by the meter under test for the established test flow rate are set out below.

– For $Q_3$ and $Q_2$: ± 4 %.

– For $Q_1$: ± 10 %.

– For zero flow rate: 0 %.

Where all errors are of the same sign, at least one error shall be less than half of the maximum permissible error.

4. References to water flow rates of commissioned meters in accordance with the Order of 28 December 1988. References in the preceding points of this Appendix to flow rates $Q_4$, $Q_3$, $Q_2$ and $Q_1$ shall be understood to be made at flow rates $Q_{max}$, $Q_n$, $Q_t$ and $Q_{min}$ respectively, in accordance with the Order of 28 December 1988.'

Ten. Annex IV is amended to read as follows:

'**ANNEX IV**
**Gas meters and volume conversion devices**

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of instruments for measuring the quantities (volumes or masses) of gas, known as gas meters, and of associated volume conversion devices, where appropriate, known as converters.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Section 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refers to the phase of in-service instruments.

Section 3. *In-service instruments subject to State metrological control.*

1. Gas meters with a maximum flow rate equal to or lower than 25 $m^3$/h, or an equivalent mass flow rate, and the associated converters, where appropriate, shall be subject to the provisions of point 4 of this Annex.

2. Gas meters with a maximum flow rate exceeding 25 $m^3$/h and equal to or lower than 250 $m^3$/h, or an equivalent mass flow rate, and the associated converters, where they exist, that are subject to State metrological control at the phase of bringing to market and commissioning, i.e. those intended for residential, commercial or light industrial use, shall be subject to the provisions of Sections 5 to 7 of this Annex. For this purpose, residential, commercial or light industrial use means use with a gas meter with a maximum flow rate that is equal to or lower than 250 $m^3$/h, or equivalent mass flow rate, that is not in a high-pressure transmission network with pressure equal to or greater than 1.6 MPa.

Section 4. Useful life.

1. In accordance with Article 8(3) of Law 32/2014 of 22 December 2014, implemented by Article 16(2) of Royal Decree 244/2016 of 3 June 2016, the useful life of gas meters with a maximum flow rate equal to or less than 25 $m^3$/h, or equivalent mass flow rate, and the associated converters shall be 20 years.

For the purposes of replacing the meters mentioned in the First Transitional Provision of this Order, and to avoid any logistical problems arising from such replacement, a period of 13 years starting from 24 October 2020 is established for the replacement of gas meters that have exceeded or that will exceed this useful life in those 13 years. The number of meters to be replaced shall be in accordance with the following schedule:

(a) by the end of the sixth year, 10 % of the total stock of meters that have exceeded their useful life shall have been replaced;

(b) by the end of the ninth year, 45 % of the total stock of meters that have exceeded their useful life shall have been replaced;

(c) by the end of the 13th year, 100 % of the total stock of meters that have exceeded their useful life shall have been replaced.

At the end of the 13th year, each distribution company may maintain up to a maximum of 2 % of the total stock of meters without replacing them provided that this is due to causes not attributable to them.

2. These meters shall not be subject to periodic verification.

3. The repair or modification of these meters is prohibited.

4. The useful life period may be extended by successive periods of five years if the gas distribution company shows that, by applying the criteria laid down for the verification in Appendix III to this Annex, the gas meters and their associated converters meet the requirements of this Annex. Verification shall be carried out by an approved metrological verification body.

5. Where the instrument holder is the consumer, they may choose to delegate to the gas distribution company the actions, operations and procedures related to the requirements on the useful life set out in this Article; and they shall agree to this and sign a document to this end that shall be filed by the gas distribution company. In the event that this delegation does not take place, the guidelines established by the competent public gas authority within its territory shall apply; the gas distribution company is required to notify the said authority of this non-delegation.

Section 5. Verification after repair or modification.

The holder of a gas meter and associated converter with a maximum flow rate greater than 25 $m^3$/h and equal to or lower than 250 $m^3$/h, or equivalent mass flow rate, after intervention by the repairer, shall organise its verification in accordance with Article 7(2) of this Order.

These instruments are covered by the provisions of Article 8 of this Order.

Section 6. Periodic verification.

Following commissioning, before the periods set out in Appendix II to this Annex have come to an end, the holder of a gas meter and associated converter with a maximum flow rate greater than 25 $m^3$/h and equal to or lower than 250 $m^3$/h shall organise its first verification in accordance with Article 14 of this Order.

The following periodic verifications shall be carried out in accordance with Appendix II to this Annex.

Section 7. Tests and maximum permissible errors in post-repair verification and periodic verification.

The maximum permissible errors in verification after repair or modification of a gas meter or converter that has not yet undergone its first periodic verification shall be the same as those established for the conformity assessment. Once this term has expired, the maximum permissible errors shall be as set out in Appendix II to this Annex.

The tests to be carried out in the post-repair verification and periodic verification and the maximum permissible errors shall be as set out in Appendix II to this Annex.

APPENDIX I

**Specific essential requirements for gas meters and volume conversion devices**

Gas meters and volume conversion devices shall continue to comply with the requirements set out in Annex IX to Royal Decree 244/2016 of 3 June 2016, and for verification after repair or modification and periodic verification, the provisions of Appendix II to this Annex shall be specifically checked.

APPENDIX II

**Technical test procedure for verification after repair or modification and for periodic verification of gas meters with a maximum flow rate exceeding 25 $m^3/h$ and equal to or lower than 250 $m^3/h$, or equivalent mass flow rate**

The verification procedure for a gas meter and converter shall be in accordance with the provisions of this Appendix.

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

1. Conditions for verification. Holders of meters and their associated converters, where they exist, shall be required to request periodic verification of the same in accordance with Article 14 of this Order before the period in years set out in Table 1 is exceeded, counting from the date of commissioning.

Table 1. Verification period

| **Measuring instrument** **Gas meter, type:** | **Period in years (first verification)** | **Period in years (subsequent verifications)** |
|---|---|---|
| Diaphragm | 10 | 5 |
| Rotary displacement | 6 | 3 |
| Turbine | 4 | 2 |
| Converter | 4 | 2 |

Where the holder of the instrument is the consumer, they may choose to delegate to the gas distribution company the actions, operations and procedures related to these verifications; and they shall agree to this and sign a document to this end that shall be filed by that company. In the event that this delegation does not take place, the guidelines established by the competent public gas authority within its territory shall

apply; the gas distribution company is required to notify the said authority of this non-delegation.

2. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

3. Metrological examination.

3.1 General requirements for conducting tests. All tests shall be carried out under the rated operating conditions described in the mandatory information and established by the manufacturer in the technical documentation associated with the conformity assessment procedure applied for bringing to market and putting into service.

During the tests, there shall be no leakage, drainage or entry into the installation between the meter being tested and the calibrated reference device.

The maximum permissible variation in the instantaneous average flow rate during testing (excluding start-up and shut-down), for the prescribed flow rate shall not exceed ± 2.5 % for the minimum flow rate ($Q_{min}$) and ± 5 % for the remaining flow rates.

The meter or converter shall be installed in accordance with the manufacturer's instructions. Gas meters of the same model and size may be installed in series, provided that the pressure at the outlet of all the meters is sufficient to ensure that there are no disturbances in their operation or interference between the meters.

The maximum permissible error requirements set out in point 3.5 shall be verified under gas conditions that are as close as possible to the measuring conditions (pressure, temperature and gas type) under which the measuring instrument was commissioned.

The installation of the meter shall be in accordance with the technical use requirements provided by the manufacturer so that the metrology of the meter will not be affected by any external element.

3.2 Expanded uncertainty in the quantity of gas measured. The verification procedure implemented in a particular test facility shall comply with the requirement that the expanded uncertainty, with a coverage factor equal to 2, in the estimation of the quantity (volume or mass) of gas passing through the meter shall not exceed 1/3 of the maximum permissible error.

3.3 Quantities of gas. The quantities of gas to be used in the tests shall be in accordance with the provisions of point 3.2 of this Appendix.

The minimum amount of gas to be used in any given continuous test at any given flow rate shall be selected so that it is at least equal to the greater of the following values:

– the quantity corresponding to one minute of operation of the meter at the corresponding flow rate;

– 200 times the value of the verification scale interval of the meter to be tested.

Smaller minimum test quantities may be accepted provided it can be proven that they comply with the requirement set out in point 3.2 of this Appendix.

3.4 Tests to be carried out. The meter tests shall be repeated three times at the following flow rates:

Table 2. Flow rates

| Type of gas meter | Test flow rates ($m^3/h$) |
|---|---|
| Diaphragm | $Q_{min}$ – $Q_t$ – $Q_{max}$ |
| Rotary displacement | $Q_{min}$ – 0.1 $Q_{max}$ – 0.25 $Q_{max}$ – 0.4 $Q_{max}$ – 0.7 $Q_{max}$ – $Q_{max}$ |
| Turbine | $Q_{min}$ – 0.1 $Q_{max}$ – 0.25 $Q_{max}$ – 0.4 $Q_{max}$ – 0.7 $Q_{max}$ – $Q_{max}$ |

If it is not possible to use a type of gas that is similar to the gas used in operation, the tests may be carried out with air and in accordance with the provisions of UNE-EN 1359. “Gas meters. Diaphragm gas meters” for diaphragm meters; in UNE-EN 12480. “Gas meters. Rotary displacement gas meters” for rotary displacement meters; and in UNE-EN 12261. “Gas meters. Turbine gas meters” for turbine meters, in force.

If the meter incorporates electronic devices, the test at zero flow rate shall also be performed.

3.5 Maximum permissible errors. The meter/converter will be deemed to be in error at a given flow rate based on the average of the errors of the three repetitions performed.

The maximum permissible error for zero flow rate tests, if they are performed, is 0 %. The maximum permissible relative errors in the quantity indicated by the meter/converter under test for the established test flow rate $Q$ are set out below.

3.5.1 Diaphragm meters. Gas meter that indicates the volume under measuring conditions or the mass.

Table 3. Maximum permissible errors for diaphragm meters

| Class | 1.5 | 1.0 |
|---|---|---|
| $Q_{min} \leq Q < Q_t$ | ± 6 % | ± 4 % |
| $Q_t \leq Q < Q_{max}$ | ± 3 | ± 2 % |

| Class | 1.5 | 1.0 |
|---|---|---|
| | % | |

If there is a gas meter with temperature conversion that indicates only the converted volume, the maximum permissible error of the meter shall be increased by 1 % over a 30 °C range that shall be symmetrically extended around the temperature specified by the manufacturer, which shall lie between 15 °C and 25 °C. Outside this range, an additional increase of 1 % is permitted over each 10 °C interval.

3.5.2 Rotary displacement and turbine meters. Gas meter that indicates the volume under measuring conditions or the mass.

Table 4. Maximum permissible errors for rotary displacement and turbine meters

| Class | 1.5 | 1.0 |
|---|---|---|
| $Q_{min} \leq Q < Q_t$ | ± 3 % | ± 2 % |
| $Q_t \leq Q < Q_{max}$ | ± 1.5 % | ± 1 % |

If there is a gas meter with temperature conversion that indicates only the converted volume, the maximum permissible error of the meter shall be increased by 0.5 % over a 30 °C range that shall be symmetrically extended around the temperature specified by the manufacturer, which shall lie between 15 °C and 25 °C. Outside this range, an additional increase of 0.5 % is permitted over each 10 °C interval.

3.5.3 Converters.

Gas volume converters may be verified either on-site, as a means of being able to reflect installation conditions at the time of verification, or in a laboratory.

Where verification is carried out in a laboratory, the following criteria shall be established:

– ± 0.5 % for pressure and temperature conversion devices, an ambient temperature of 20 °C ± 3 °C, an ambient humidity of 60 % ± 15 %, and nominal values for the energy supply;

– ± 0.7 % for temperature conversion devices in rated operating conditions;

– ± 1 % for other conversion devices in rated operating conditions.

The error of the gas meter shall not be taken into account.

Where the verification is carried out on-site, the following criteria shall be established:

– ± 0.5 % for pressure and temperature conversion devices, with stable ambient temperatures within the temperature range for use of the converter and standard equipment used as a test reference and stable ambient humidity within the humidity range of use of the converter and standards used as a test reference and with the nominal values for the energy supply;

– ± 0.7 % for temperature conversion devices, with stable ambient temperatures within the temperature range for use of the converter and standard equipment used as a test reference and stable ambient humidity within the humidity range of use of the converter and standards used as a test reference and with the nominal values for the energy supply;

– ± 1 % for other conversion devices, with stable ambient temperatures within the temperature range for use of the converter and standard equipment used as a test reference and stable ambient humidity within the humidity range of use of the converter and standards used as a test reference and with the nominal values for the energy supply;

- The error of the gas meter shall not be taken into account.

## APPENDIX III

### Technical procedure for verification tests for increasing the useful life of gas meters with a maximum flow rate equal to or lower than 25 $m^3/h$ or equivalent mass flow rate

The verification procedure for a gas meter and converter shall be in accordance with the provisions of this Appendix.

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

Verification may be carried out either by unit or by statistical sampling, bearing in mind that, for the purposes of this Order, the holder that is required to verify a gas meter is:

(a) in the case of verification by unit, the owner of the instrument;

(b) in the case of verification by statistical sampling, the gas distribution company.

1. Verification by statistical sampling.

1.1 To be able to apply verification by statistical sampling, it is the responsibility of the gas distribution company to group the gas meters subject to verification by statistical sampling in homogeneous lots.

1.2 All instruments that form part of a verified lot are deemed to have undergone periodic verification tests.

1.3 The gas distribution company may submit lots of instruments to verification by statistical sampling after informing the approved verification body or the competent public authority of the identification of the instruments that make up each of the lots created.

1.4 If the verified lot does not meet the requirements established, the gas distribution company shall take the necessary measures to prevent the lot remaining in service.

1.5 Where the gas distribution company is not the holder of all or part of a lot, it is the responsibility of the company to agree with the holder to include the instruments in a lot.

1.6 The gas distribution company that has constituted the lot shall inform the competent public authority of any changes to the lot that could call its constitution into question. A change to a lot leads to a new lot being formed. If the lot has not been modified during the period of validity of the verification, the gas distribution company shall inform the approved metrological verification body or the competent public authority of the next verification at least three months before this verification takes place.

2. Criteria for the formation and delimitation of a lot. Only gas meters that meet the following minimum requirements may be included in a lot:

(a) the same year of manufacture;

(b) the same maximum flow rate ($Q_{max}$);

(c) the same ratio of maximum flow rate to minimum flow rate ($Q_{max}/Q_{min}$);

(d) the same nominal diameter (DN);

(e) the same meter mark and model;

(f) the same operational/supply conditions.

2.1 Once the lot has been established, the representative sample of the lot shall be maintained for all subsequent verifications based on sampling verifications. The same gas meter can be selected for only one lot.

2.2 For implementation of the verification by statistical sampling of gas meters, the following information shall be provided:

(a) maximum flow rate ($Q_{max}$);

(b) ratio of maximum flow rate to minimum flow rate ($Q_{max}/Q_{min}$);

(c) nominal diameter (DN);

(d) identification of type or model;

(e) manufacturer;

(f) metrological marking;

(g) date of commissioning or of the last verification;

(h) lot size;

(i) entity of public utility that owns the gas meters;

(j) declaration by the company or entity of public utility as to whether the lot for which the verification by sampling applies has previously undergone verification by sampling;

(k) date on which the gas meters selected for verification by sampling are expected to be removed from the network and made available for verification;

(l) chosen sampling plan.

2.3 Selection and processing of the gas meters in the sample. Before carrying out the tests, the approved metrological verification body and the applicant shall agree on the following:

(a) procedure and specifications for the random sampling of gas meters (e.g. by manufacturer's serial number, by holder, using a table of random numbers or a program for computer-assisted generation of random numbers) to ensure that the sample is random and representative of the lot;

(b) sampling plan to be applied;

(c) date or period for removing the gas meters that comprise the sample from the network, date of their delivery to the verification body, place and period of verification between the two operations and date of verification of the meters tested; and

(d) procedure to reduce the possibility of inadmissible interventions in the gas meters that comprise the sample during the period between their removal from the network and verification.

2.4 The period between removal of the gas meters from the supply network and their verification shall be as short as possible and, in any event, shall not exceed one month.

2.5 No intervention such as repair, adjustment, meter change, etc. is allowed.

2.6 Depending on the size of the lot and the sampling plan chosen, the gas meters in the sample and the spare gas meters shall be selected from the defined lot. The selection shall be made according to the rules of mathematical statistics, i.e. the probability of being selected as a sample gas meter or as a spare gas meter shall be the same for each gas meter in the lot.

2.7 Non-compliant gas meter. A meter that is part of the sample shall be considered non-compliant if it does not comply with the specifications of the conformity assessment certificate or if it does not comply with the verification requirements.

2.8 Spare gas meters.

(a) If the selected sample gas meters include meters that:

(i) show external damage;

(ii) have broken seals;

(iii) cannot be located;

(iv) have been incorrectly submitted;

replacement of such meters with spare gas meters is permitted before the verification process starts.

(b) The actual number of gas meters that can be replaced by spare gas meters depends on the size of the lot and is set out in point 3 of this Appendix.

(c) There shall be only one replacement period, immediately after the visual examination. Spare gas meters used for replacement shall be randomly chosen from the lots formed.

(d) If it is not possible to complete the whole sample in accordance with the above provisions, the request for verification by statistical sampling shall be rejected.

2.9 Retention period. The approved metrological verification body or competent public authority may set a time limit until which the sample of gas meters or converters shall remain unchanged. This period shall not exceed one month from the date of verification by statistical sampling to the date of possible verification.

2.10 Sampling plan. The sampling plans applicable to verification by statistical sampling are set out in point 3 of this Appendix.

From a statistical point of view, the sampling plans set out in Table 5 and Table 6 of this Appendix are equivalent to each other and binding on the body performing the verifications. For lots of more than 35 000 units, the tables in point 3 of this Appendix may be extended in accordance with ISO Standard 2859-2. “Sampling procedures for inspection by attributes. Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection”, in force.

To obtain a higher probability of acceptance of lot sizes, a sampling plan may be chosen that is applicable to larger lot sizes with a correspondingly larger sample size.

Changing the sampling plan originally chosen to another after the verification has started is not allowed.

2.11 Verification result. The lot shall be accepted if the sampling plan requirements have been met.

Even if the lot is declared compliant, gas meters in the sample that do not comply with the requirements shall be taken out of service.

If the lot is rejected, all the units in the lot must be taken out of service.

If the lot is accepted after verification by statistical sampling has been carried out in accordance with one of the sampling plans set out in point 3 of this Appendix, the gas meters and their associated converters that form part of the lot may remain in service for the five-year period set out in point 4.4 of this Annex.

The competent public authority shall be informed of the result of the verification by statistical sampling. The approved metrological verification body shall provide the results of the verification if these are requested by the competent public authority.

2.12 Verification label. The verification label established in Article 17 of this Order shall be affixed only to the compliant gas meters in the representative sample of the lot verified. For the other gas meters belonging to the lot verified, the gas distribution company shall inform the holders of those instruments of the extension of their useful life.

3. Sampling plans. Verification by statistical sampling of lots may be carried out based on one of the sampling plans described below.

Table 5. Verification by single sampling

| Lot size | Sample size | Number of non-compliant meters | | Spare meters |
|---|---|---|---|---|
| | | Lot acceptance | Lot rejection | |
| 0 to 1 200 | 50 | 1 | 2 | 10 |
| 1 201 to 3 200 | 80 | 3 | 4 | 16 |
| 3 201 to 10 000 | 125 | 5 | 6 | 25 |
| 10 001 to 35 000 | 200 | 10 | 11 | 40 |

Table 6. Verification by double sampling

| Lot size | Sample | Sample size | Cumulative sample size | Number of non-compliant meters | | | Spare meters |
|---|---|---|---|---|---|---|---|
| | | | | Lot acceptance | Lot rejection | Need for 2nd sample | |
| 0 to | First | 32 | 32 | 0 | 2 | 1 | 6 |

| Lot size | Sample | Sample size | Cumulative sample size | Number of non-compliant meters | | | Spare meters |
|---|---|---|---|---|---|---|---|
| | | | | Lot acceptance | Lot rejection | Need for 2nd sample | |
| 1 200 | Second | 32 | 64 | 1 | 2 | | 6 |
| 1 201 to 3 200 | First | 50 | 50 | 1 | 4 | 2 to 3 | 10 |
| | Second | 50 | 100 | 4 | 5 | | 10 |
| 3 201 to 10 000 | First | 80 | 80 | 2 | 5 | 3 to 4 | 16 |
| | Second | 80 | 160 | 6 | 7 | | 16 |
| 10 001 to 35 000 | First | 125 | 125 | 5 | 9 | 6 to 8 | 25 |
| | Second | 125 | 250 | 12 | 13 | | 25 |

In each row corresponding to a second sample, the number of non-compliant meters refers to the cumulative sample size.

The installation of the meter must comply with the technical requirements for use provided by the manufacturer so that the metrological specifications of the meter will not be affected by any external element and do not distort the flow of gas or the converter.

4. Metrological examination. This examination shall be performed in accordance with point 3. Metrological examination, of Appendix II to this Annex.'

Eleven. Annex VI is amended to read as follows:

'**ANNEX VI**

**Systems for the continuous and dynamic measurement of quantities of liquids other than water.**

Section 1. *Purpose*

The purpose of this Annex is to regulate State metrological control of measuring systems intended for the continuous and dynamic measurement of quantities (volumes or masses) of liquids other than water, of the following types:

(a) fuel pumps or dispensers (excluding liquefied gases);
(b) measuring systems for low-viscosity liquids (≤ 20 mPa·s) in tankers;

(c) pumps or dispensers intended for the supply to motor vehicles of substances not intended for use as fuel;

(d) measuring system for the supply of liquefied petroleum gases (LPG) for motor vehicles (LPG pumps or dispensers);

(e) measuring systems in tankers for the supply of cryogenic liquids with a boiling point of less than – 153 °C, for the supply of liquefied carbon dioxide and for the supply of liquefied natural gas (LNG).

All the above are hereinafter referred to as measuring systems.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Section 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refers to the phase of in-service instruments , which includes verification after repair or modification and/or periodic verification.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service measuring systems is set out in Annex XII to Royal Decree 244/2016 of 3 June 2016.

Section 4. Verification after repair or modification.

Verification after repair or modification of measuring systems shall be carried out in accordance with Chapter III of this Order and Appendix II to this Annex.

These instruments are encompassed by the provisions Article 8 of this Order.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix II to this Annex.

The periodic verification period shall be one year.

Measuring systems in tankers for the supply of cryogenic liquids with a boiling point below 120 K (– 153 °C) for the supply of liquefied carbon dioxide and for the supply of liquefied natural gas (LNG) in service upon the entry into force of this amendment to the Order have a period of one year from its entry into force to undergo their first periodic verification.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix II to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

## APPENDIX I

## Specific essential requirements for measuring systems

For the purposes of the technical content of this Appendix, the terminology used is that of the International Organization of Legal Metrology (OIML).

The maximum permissible errors are set out in each of the tests listed in Appendix II.

The relative errors, expressed in %, are calculated according to the formulae listed below.

$$e_r = [(V_{ind} - V_p) / V_p] \times 100$$

where:

$V_{ind}$ volume indicated by the measuring system;

$V_p$ volume measured by the standard;

$e_r$ percentage relative error in the volume indicated by the measuring system.

$$m_r = [(m_{ind} - m_p)/ m_p] \times 100$$

where:

$m_{ind}$ mass indicated by the measuring system;

$m_p$ mass measured by the standard;

$m_r$ percentage relative error in the mass indicated by the measuring system.

The reference measuring system (standard) used to determine volume or mass indication errors shall have an expanded uncertainty of less than 1/3 of these maximum permissible errors. If it is not possible to achieve the expanded uncertainty stated above, the reduced maximum error shall be applied as shown in the following formula:

reduced maximum error (mpe) = (4/3 x mpe – U)

*U* is the expanded uncertainty for a coverage factor of *k=2.*

APPENDIX II

**Technical test procedure for verification after repair or modification and for periodic verification of measuring systems**

1. General points. The procedure for verification after repair or modification and for periodic verification for measuring systems shall consist of the procedures and actions set out below.

For the purposes of this Annex, if several measuring systems intended for separate measuring operations have common elements (calculator, filter, gas removal device, conversion devices, etc.), each measuring system shall be considered to form a pump or dispenser, sharing the common elements.

If the repair or modification involves exclusively the removal of seals from one or more pumps or dispensers, without it being necessary to remove the seals of shared common elements, verification after repair or modification shall be carried out only on those pumps or dispensers where the seals on their specific components have been removed.

Where the repair or modification involves removing seals from common elements shared by several pumps or dispensers, whether or not it is necessary to remove the specific seals on each of them, verification after repair or modification shall be carried out on all the pumps or dispensers that share the common elements being repaired or modified.

In accordance with the provisions of Article 11(3) of this Order, verifications after repair or modification shall have the effect of periodic verification with respect to calculating the term to request periodic verification of the pumps that have been verified. However, the holders of such pumps may request their periodic verification before the new date for the said verification is reached, so that it coincides with that of other existing pumps or dispensers at the same establishment that they also hold.

When verification of a pump or dispenser is carried out, a verification or disqualification label shall be affixed to each of the nozzles of the said pump or dispenser in clear view above the space where it rests. If several pumps or dispensers share common elements and housing, the corresponding verification or disqualification labels shall be placed only above the space where the nozzles of the verified pumps or dispensers rest.

All tests shall be carried out under the rated operating conditions described in the certificate associated with the conformity assessment procedure applied for bringing to market and putting into service.

2. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

3. Metrological examination. The measuring systems shall continue to satisfy the essential requirements that gave rise to them being brought to market and put into service, in particular, compliance with the established requirements shall be verified by means of the corresponding tests set out below.

3.1 Necessary resources.

3.1.1 Without prejudice to point 3.1.2 of this Appendix, the equipment listed below may be used to determine the quantity of liquid that passes through the meter.

Standard vessels: for fuel pumps or dispensers (excluding liquefied gases).

Standard vessels or standard meters: for measuring systems in tankers for low-viscosity liquids (≤ 20 mPa·s).

Standard vessels: for pumps or dispensers, intended for the supply to motor vehicles of substances not intended for use as fuel.

Standard meter: for measuring systems for the supply of liquefied petroleum gases (LPG) for motor vehicles (LPG pumps or dispensers), measuring systems on tankers for the supply of liquefied carbon dioxide, measuring systems for the supply of liquefied natural gas (LNG) and measuring systems for cryogenic liquids with a boiling point lower than 120 K (– 153 °C).

3.1.2 Weighing instruments, pipe meters (measuring loops) or standard meters may be used, provided that the measurement methods are consistent with the maximum permissible errors of each test. In addition, suitable supplementary devices such as flowmeters or thermometers shall be used.

3.1.3 If standard meters are used, they shall be positioned in series with the measuring system to be tested, as close as possible to the system. The shut-off valve to control the test fluid flow rate and the initiation and interruption of the flow shall be located downstream of the standard meter and shall be slowly opened and closed to avoid water hammers and pressure spikes. Avoid the creation of high points in pipes or hoses, to prevent air pockets forming, and sharp bends are not advisable.

3.1.4 The necessary resources set out in the above points shall be calibrated with traceability to national or international standards.

3.1.5 The holder of the measuring system shall cooperate in carrying out the verification by providing sufficient quantity of product for the tests established. The holder may freely decide whether or not to recover the product; if discarded, the holder is responsible for its proper disposal.

(A) Measuring systems known as fuel pumps or dispensers (excluding liquefied gases)

A.1 Description of the test method using standard vessels.

1. Preparatory operations. Before starting the tests, the preparatory operations described below shall be carried out.

1.1 Cable verification. The integrity of the connecting cable(s) between the pulse emitter and the pump/dispenser computer shall be checked.

1.2 Wetting of the standard vessel. If the verification is carried out after an extended period of inactivity of the vessel, the vessel shall first be wetted.

After wetting, the standard vessel shall be emptied and drained. Unless expressly stated otherwise on the calibration certificate, the drainage operation shall be considered complete 30 seconds after interruption of the permanent flow rate.

2. Minimum quantity test. The purpose of the minimum quantity test is to determine the error of the pump or dispenser at the minimum measured quantity. For this purpose, a standard vessel is used with nominal capacity equal to the minimum measured quantity of the pump/dispenser. The test shall be performed at a flow rate as close as possible to the minimum flow rate indicated on the name plate of the pump/dispenser and under normal conditions of use.

The maximum permissible error is ± 1 % of the minimum measured quantity or ± 0.5 % if the quantity is twice the minimum measured quantity.

If the pump or dispenser has not operated for more than six hours before the verification, this test may be repeated and the results obtained in the first test may be disregarded.

3. Test at maximum flow rate. The purpose of the test at maximum flow rate is to determine the error of the system at its maximum flow rate under normal conditions of use. For this purpose, a standard vessel is used with nominal capacity capable of holding at least the volume supplied by the system tested in one minute of operation at that maximum flow rate.

This test is carried out under normal conditions of use and following the phases set out below.

3.1 Where applicable, the vessel shall be emptied and drained after the wetting operation or a previous test. Unless expressly stated otherwise on the calibration certificate, the drainage operation shall be considered complete 30 seconds after interruption of the permanent flow rate.

3.2 The test shall be started, to which end the system nozzle shall be unhooked and drained and, if necessary, the indicating device shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero). The test volume corresponding to the nominal capacity of the vessel used shall be poured into the standard vessel at the system's maximum flow rate.

The maximum flow rate provided by the system shall be greater than 60 % of the maximum flow value $Q_{max}$ given on the name plate. If the system's maximum flow rate does not meet this requirement, the system shall be repaired and subsequently verified.

3.3 The volume indicated on the vessel shall then be read and the relative error calculated. The maximum permissible error is ± 0.5 %.

4. Test at reduced flow rate. The purpose of the test at reduced flow rate is to verify the internal sealing of the measuring system. It is carried out at a flow rate appreciably greater than the minimum flow rate but no greater than 50 % of the flow rate used for the test at maximum flow rate. A standard vessel shall be used of nominal capacity capable of holding at least the volume discharged by the pump or dispenser tested in one minute of operation at 50 % of the flow rate used in the test at maximum flow rate. It shall be carried out following the same steps as in the test at maximum flow rate.

If the pump/dispenser has the volume preset function, these tests may be performed using this function set to the nominal capacity of the standard vessel used.

The maximum permissible error is ± 0.5 %.

5. General operation tests.

5.1 Zero-setting device. This consists of unhooking the nozzle and verifying that both the volume and the amount indicators are correctly set at zero.It may be necessary, where appropriate, to wait for the process of authorising the supply if this is remotely controlled by an external system.

The security of the zero-setting for self-service pumps or dispensers used with a control room shall be verified by unhooking the nozzle and checking that, after putting the pump or dispenser into operation, the indicating device does not reset to zero until authorisation for use has been issued from the control room.

The maximum permissible error is:

With a discontinuous indicating device: ± 0 %.

With a continuous indicating device: ± 0.5 % of the minimum measured quantity.

5.2 Unit price control. This verification shall be conducted during the test at the maximum flow rate and calculated as the difference between the indicated total price and the calculated total price based on the indicated volume and the unit price.

The maximum permissible error shall be ± 1 % of the minimum measured quantity.

5.3 Control of the emergency power supply. The correct functioning of the emergency power supply in the event of a cut in the power supply to the pump/dispenser shall be verified.

(B) Measuring systems in tankers for low-viscosity liquids (≤ 20 mPa·s)

B.1 Description of the test method using standard vessels.

1. Preparatory operations. Before starting the tests, the preparatory operations described below shall be carried out.

1.1 Wetting of the standard vessel. If the verification is carried out after an extended period of inactivity of the vessel, the vessel shall first be wetted.

After wetting, the standard vessel shall be emptied and drained. Unless expressly stated otherwise on the calibration certificate, the drainage operation shall be considered complete 30 seconds after interruption of the permanent flow rate.

1.2 Checking the pulse emitter cable. The integrity of the cable(s) between the pulse emitter and the measuring system computer shall be checked in electronic measuring systems that transform the movement of the shaft of the measuring system into electric pulses. This check is unnecessary when the measurement chamber and the electronic head are integrated.

1.3 Visual inspection of the piping system. The integrity of the piping that connects the measuring system meter outlet flange and the connecting flange of the hoses or hose reels shall be checked, paying particular attention to the existence of piping or branches that allow the product already measured to be diverted or returned to the tank, to another auxiliary tank or to the circuit itself upstream of the meter. Any branches or purges that are not covered by the conformity assessment of the system shall be considered unauthorised.

1.4 If the tanker has compartments for more than one product, the piping system shall be checked to ensure it is designed in such a way as to prevent those products from mixing in the measuring system.

1.5 Check of correct functioning of the zero-setting device.

1.6 If the meter is fitted with a receipt printer, the printing mechanism shall be associated with the zero-setting device of the volume indicator. It shall be checked that

the meter indication and the printed indication match. To homogenise the measurement chambers and eliminate any gas pockets, a minimum quantity of 500 litres shall be passed through the system before starting the tests, except where the measuring system has not operated for a period exceeding six hours prior to the verification, in which event the highest of the following values shall be passed through the system:

– 500 litres;

– volume supplied by the system in one minute at the maximum flow rate.

For systems with more than one hose, the following tests may be carried out on any one of them.

2. Test at minimum flow rate. The purpose of the test at minimum flow rate is to determine the error of the measuring system at its minimum flow rate. For this purpose, a standard vessel is used with nominal capacity capable of holding at least the volume supplied by the system tested in one minute of operation at that minimum flow rate.

This test is carried out under normal conditions of use following the phases set out below.

2.1 Adjust the flow rate so that its value is as close as possible to, but never less than, the value of $Q_{min}$ given on the name plate.

2.2 The system indicating device shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

2.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute.

2.4 The test volume corresponding to the nominal capacity of the vessel used shall be poured into the standard vessel at the preset flow rate.

2.5 The relative error shall be calculated.

2.6 Steps 2.2 to 2.5 shall be repeated twice and a total of three relative errors calculated: $e_{r1}$, $er_{r2}$ and $e_{r3}$.

2.7 The test shall be deemed invalid if the repeatability of the relative errors of two consecutive measurements obtained under stable conditions is greater than 0.1 %, in which event, the entire test shall be repeated. If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

2.8 The relative error of the measuring system at minimum flow rate shall be calculated as the average of the three errors obtained in point 2.6. The maximum permissible error is ± 0.5 %.

3. Test at maximum flow rate. The purpose of the test at maximum flow rate is to determine the error of the measuring system at its maximum flow rate and is performed under normal conditions of use, in the phases described below.

3.1 Adjust the flow rate so that its value is as close as possible to, but never greater than, the value of the maximum flow rate $Q_{max}$ given on the name plate. This value shall be at least 60 % of $Q_{max}$.

3.2 The system indicating device shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

3.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute.

3.4 The test volume corresponding to the nominal capacity of the vessel used shall be poured into the standard vessel at the preset flow rate.

3.5 The volume indicated on the vessel shall then be read and the relative error calculated.

3.6 Steps 3.2 to 3.5 shall be repeated twice and a total of three relative errors calculated: $e_{r1}$, $er_{r2}$ and $e_{r3}$.

3.7 The test shall be deemed invalid if the repeatability of the errors of two consecutive measurements obtained under stable conditions is greater than 0.1 %, in which event, the entire test shall be repeated. If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

3.8 The relative error of the measuring system at maximum flow rate shall be calculated as the average of the three errors obtained in point 3.6. The maximum permissible error is ± 0.5 %.

4. General operation tests. General operation tests may be carried out after the maximum and minimum flow rate tests or while carrying them out.

4.1 Measuring systems with more than one hose. It shall be checked that while the meter is operating it is impossible to make a change to the supply conduit without the consequent termination of the supply operation. A supply operation shall be deemed to have been terminated if the indicating device has to be brought to zero to be able to perform another measurement.

4.2 Minimum measured quantity. This test shall be carried out only after repair or replacement of the hose of a full-hose type measuring system.

To determine the minimum measured quantity, a standard vessel with nominal capacity equal to the minimum measured quantity of the system is used. The test shall be

performed at a flow rate as close as possible to the minimum flow rate indicated on the name plate of the system and under normal conditions of use.

The maximum permissible error is ± 1 % of the minimum measured quantity.

If the hoses are coiled, the internal volume increase resulting from changing the position of the coiled hose not under pressure to the uncoiled hose under pump pressure without liquid flow shall not exceed twice the maximum permissible error for the minimum measured quantity.

$$V_{ind} \leq 0.02 \times MMQ,$$

where

$V_{ind}$ Volume indicated by the measuring system

*MMQ* minimum measured quantity

If the system does not have a reel, the increase in internal volume shall not exceed the maximum permissible error for the minimum measured quantity.

$$V_{ind} \leq 0.01 \times MMQ$$

B.2 Description of the test method using standard meters.

1. Preparatory operations. Before starting the tests, the preparatory operations described below shall be carried out.

1.1 Preliminary checks. The standard meter shall be positioned in series with the measuring system to be tested, as close as possible to the measuring system.

The shut-off valve to control the test fluid flow rate and the initiation and interruption of the flow shall be located downstream of the standard meter and shall be slowly opened and closed to avoid water hammers and pressure spikes.

Avoid the creation of high points in pipes or hoses, to prevent air pockets forming, and sharp bends are not advisable.

1.2 Checking the pulse emitter cable. The integrity of the cable(s) between the pulse emitter and the measuring system computer shall be checked in electronic measuring systems that transform the movement of the shaft of the measuring system into electric pulses. This check is unnecessary when the measurement chamber and the electronic head are integrated.

1.3 Visual inspection of the piping system. The integrity of the piping that connects the measuring system meter outlet flange and the connecting flange of the hoses or hose reels shall be checked, paying particular attention to the existence of piping or

branches that allow the product already measured to be diverted or returned to the tank, to another auxiliary tank or to the circuit itself upstream of the meter. Any branches or purges that are not covered by the conformity assessment of the system shall be considered unauthorised.

1.4 If the tanker has compartments for more than one product, the piping system shall be checked to ensure it is designed in such a way as to prevent those products from mixing in the measuring system.

1.5 Check of correct functioning of the zero-setting device.

1.6 If the meter is fitted with a receipt printer, the printing mechanism shall be associated with the zero-setting device of the volume indicator. It shall be checked that the meter indication and the printed indication match. To homogenise the measurement chambers and eliminate any gas pockets, a minimum quantity of 500 litres shall be passed through the system before starting the tests, except where the measuring system has not operated for a period exceeding six hours prior to the verification, in which event the highest of the following values shall be passed through the system:

– 500 litres;

– volume supplied by the system in one minute at the maximum flow rate.

For systems with more than one hose, the following tests may be carried out on any one of them.

2. Test at minimum flow rate. The purpose of the test at minimum flow rate is to determine the error of the measuring system at the minimum flow rate in use and it is performed under normal conditions of use, in the phases described below.

2.1 The flow rate shall be adjusted so that its value is as close as possible to, but never less than, the value of $Q_{min}$ given on the name plate.

2.2 The system indicating device and the standard meter shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

2.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute.

2.4 The calculation of the volume measured by the standard meter shall be corrected for flow rate deviation and product temperature.

$$V_p = KV_{cp}$$

where

$V_{cp}$ Volume indicated by the standard meter.

$K$ Correction factor of the standard meter based on the flow rate and type of product.

2.5 The relative error shall be calculated.

2.6 Steps 2.2 to 2.5 shall be repeated twice, and a total of three relative errors calculated: $e_{r1}$, $e_{r2}$ and $e_{r3}$.

2.7 The test shall be deemed invalid if the repeatability of the relative errors of two consecutive measurements obtained under stable conditions is greater than 0.1 %, in which event, the entire test shall be repeated. If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

2.8 The relative error of the measuring system at minimum flow rate shall be calculated as the average of the three errors obtained in point 2.6. The maximum permissible error is ± 0.5 %.

3. Test at maximum flow rate. The purpose of the test at maximum flow rate is to determine the error of the measuring system at its maximum flow rate and is performed under normal conditions of use, in the phases described below.

3.1 The flow rate shall be adjusted so that its value is as close as possible to, but never greater than, the value of the maximum flow rate $Q_{max}$ given on the name plate. This value shall be at least 60 % of $Q_{max}$.

3.2 The system indicating device and the standard meter shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

3.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute.

3.4 The calculation of the volume measured by the standard meter shall be corrected for flow rate deviation and product temperature.

$$V_p = KV_{cp}$$

where

$V_{cp}$ Volume indicated by the standard meter.

$K$ Correction factor of the standard meter based on the flow rate and type of product.

3.5 The relative error shall be calculated.

3.6 Steps 3.2 to 3.5 shall be repeated twice, and a total of three relative errors calculated: $e_{r1}$, $er_{r2}$ and $e_{r3}$.

3.7 The test shall be deemed invalid if the repeatability of the errors of two consecutive measurements obtained under stable conditions is greater than 0.1 %, in which event, the entire test shall be repeated. If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

3.8 The relative error of the measuring system at maximum flow rate shall be calculated as the average of the three errors obtained in point 3.6. The maximum permissible error is ± 0.5 %.

4. General operation tests. General operation tests may be carried out after the maximum and minimum flow rate tests or while carrying them out.

4.1 Measuring systems with more than one hose. It shall be checked that while the meter is operating it is impossible to make a change to the supply conduit without the consequent termination of the supply operation. A supply operation shall be deemed to have been terminated if the indicating device has to be brought to zero to be able to perform another measurement.

4.2 Minimum measured quantity. This test shall be carried out only after repair or replacement of the hose of a full-hose type measuring system.

A standard meter shall be used to determine the minimum measured quantity. The test shall be performed at a flow rate as close as possible to the minimum flow rate indicated on the name plate of the system and under normal conditions of use.

The maximum permissible error is ± 1 % of the minimum measured quantity.

If the hoses are coiled, the internal volume increase resulting from changing the position of the coiled hose not under pressure to the uncoiled hose under pump pressure without liquid flow shall not exceed twice the maximum permissible error for the minimum measured quantity.

$$V_{ind} \leq 0.02 \times MMQ$$

where:

$V_{ind}$ Volume indicated by the measuring system

*MMQ* minimum measured quantity

If the system does not have a reel, the increase in internal volume shall not exceed the maximum permissible error for the minimum measured quantity.

$$V_{ind} \leq 0.01 \times MMQ$$

(C) Measuring systems, known as pumps or dispensers, intended for the supply to motor vehicles of substances not intended for use as fuel: solutions of urea in water

C.1 Description of the test method using standard vessels.

1. Preparatory operations. Before starting the tests, the preparatory operations described below shall be carried out.

1.1 Cable verification. The integrity of the connecting cable(s) between the pulse emitter and the pump/dispenser computer shall be checked.

1.2 Wetting of the standard vessel. If the verification is carried out after an extended period of inactivity of the vessel, the vessel shall first be wetted.

2. Minimum quantity test. The purpose of the minimum quantity test is to determine the error of the pump or dispenser at the minimum measured quantity. For this purpose, a standard vessel is used with nominal capacity equal to the minimum measured quantity of the pump/dispenser. The test shall be performed at a flow rate as close as possible to the minimum flow rate indicated on the name plate of the pump/dispenser and under normal conditions of use.

The maximum permissible error for minimum measured quantities greater than or equal to 2 L is ± 1 % of the minimum measured quantity, for minimum measured quantities of less than 2 L it is as set out in Table 1 below.

Table 1. Maximum permissible error for minimum measured quantities of less than 2 L

| **Minimum measured quantity (*MMQ*)** | **Maximum permissible error** |
|---|---|
| From 1 L to 2 L | ± 1 % |
| From 0.4 L to 1 L | ± 1 % of *MMQ* |
| From 0.2 L to 0.4 L | ± 0.4 % |
| From 0.1 L to 0.2 L | ± 2 % of *MMQ* |
| Less than 0.1 L | ± 0.2 % |

3. Test at maximum flow rate. The purpose of the test at maximum flow rate is to determine the error of the pump or dispenser at its maximum flow rate under normal conditions of use. For this purpose, a standard vessel is used with nominal capacity capable of holding at least the volume discharged by the pump/dispenser tested in one minute of operation at that maximum flow rate.

This test is carried out under normal conditions of use and following the phases set out below.

3.1 Where applicable, the vessel shall be emptied and drained after the wetting operation or a previous test. Unless expressly stated otherwise on the calibration certificate, the drainage operation shall be considered complete 30 seconds after interruption of the permanent flow rate.

3.2 The test shall be started at maximum flow rate, to which end the nozzle of the pump or dispenser shall be unhooked and drained and, if necessary, the indicating device shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero). The volume corresponding to the nominal capacity of the vessel used shall be poured into the standard vessel at the maximum flow rate permitted by the system.

The maximum flow rate supported by the system shall be greater than 60 % of the maximum flow value $Q_{max}$ given on the name plate. If the maximum flow rate provided by the system does not meet this requirement, the system shall be repaired and subsequently verified.

3.3 The volume indicated on the vessel shall then be read and the relative error calculated. The maximum permissible error is ± 0.5 %.

4. Test at reduced flow rate. The purpose of the test at reduced flow rate is to verify the internal sealing of the measuring system. It shall be carried out at a flow rate appreciably greater than the minimum flow rate and not more than 50 % of the flow rate used in the test at maximum flow rate and a standard vessel shall be used of nominal capacity capable of holding at least the volume discharged by the pump or dispenser tested in one minute of operation at 50 % of the flow rate used in the test at maximum flow rate. It shall be carried out following the same steps as in the test at maximum flow rate.

If the pump/dispenser has a volume preset function, these tests may be performed using this function set to the nominal capacity of the standard vessel used.

The maximum permissible error is ± 0.5 %.

5. General operation tests.

5.1 Zero-setting device. This consists of unhooking the nozzle and verifying that both the volume and the amount indicators are correctly set at zero.It may be necessary, where appropriate, to wait for the process of authorising the supply if this is remotely controlled by an external system.

The security of the zero-setting for self-service pumps or dispensers used with a control room shall be verified by unhooking the nozzle and checking that, after putting the pump or dispenser into operation, the indicating device does not reset to zero until authorisation for use has been issued from the control room.

The maximum permissible error is:

With a discontinuous indicating device: ± 0 %.

With a continuous indicating device: ± 0.5 % of the minimum measured quantity.

5.2 Unit price control. This verification shall be conducted during the test at the maximum flow rate and calculated as the difference between the indicated total price and the calculated total price based on the indicated volume and the unit price.

The maximum permissible error shall be ± 1 % of the minimum measured quantity.

5.3 Control of the emergency power supply. The correct functioning of the emergency power supply in the event of a cut in the power supply to the pump/dispenser shall be verified.

(D) Measuring system for the supply of liquefied petroleum gas (LPG) for motor vehicles, hereinafter, LPG pumps or dispensers.

D.1 Description of the test method using standard meters.

1. Preparatory operations. Before starting the tests, the preparatory operations described below shall be carried out.

1.1 Cable verification. The integrity of the connecting cable(s) between the pulse emitter and the computer shall be checked.

1.2 Preliminary run-in. The standard meter shall be connected and the pump or dispenser and standard meter assembly subjected to a preliminary run-in of 100 L of product at the system's maximum flow rate, under normal conditions of use, to load the circuit between the standard meter and the measuring system to be verified.

2. Minimum quantity test. The purpose of this minimum quantity test is to determine the error of the pump or dispenser at the minimum measured quantity. This test shall be carried out in accordance with Recommendation OIML R 117. "Dynamic measuring systems for liquids other than water", as indicated in the corresponding Annex, in its version in force.

The maximum permissible error for minimum measured quantities greater than or equal to 2 L is ± 2 % of the minimum measured quantity, for minimum measured quantities of less than 2 L it is as set out in Table 2 below.

Table 2. Maximum permissible error for minimum measured quantities of less than 2 L

| **Minimum measured quantity (*MMQ*)** | **Maximum permissible error** |
|---|---|
| From 1 L to 2 L | ± 2 % |

| Minimum measured quantity (*MMQ*) | Maximum permissible error |
|---|---|
| From 0.4 L to 1 L | ± 2 % of *MMQ* |
| From 0.2 L to 0.4 L | ± 0.8 % |
| From 0.1 L to 0.2 L | ± 4 % of *MMQ* |
| Less than 0.1 L | ± 0.4 % |

3. Test at maximum flow rate. The purpose of the test at maximum flow rate is to determine the error of the measuring system at its maximum flow rate under normal conditions of use. This test shall be carried out in accordance with the provisions of the version of Recommendation OIML R 117 in force at the time of testing.

The relative error shall be calculated.

The maximum permissible error in each of the tests is ± 1 %.

4. Test at minimum flow rate. The purpose of the test at minimum flow rate is to determine the error of the measuring system at its minimum flow rate under normal conditions of use. This test shall be carried out in accordance with the provisions of the version of Recommendation OIML R 117 in force at the time of testing.

The relative error shall be calculated.

The maximum permissible error in each of the tests is ± 1 %.

5. General operation tests.

5.1 Zero-setting device. This consists of unhooking the nozzle and verifying that both the volume and the amount indicators are correctly set at zero.It may be necessary, where appropriate, to wait for the process of authorising the supply if this is remotely controlled by an external system.

The security of the zero-setting for self-service pumps or dispensers used with a control room shall be verified by unhooking the nozzle and checking that, after putting the pump or dispenser into operation, the indicating device does not reset to zero until authorisation for use has been issued from the control room.

The maximum permissible error is:

With a discontinuous indicating device: ± 0 %.

With a continuous indicating device: ± 1 % of the minimum measured quantity.

5.2 Verification of hose expansion and drainage. The purpose of this test is to check the expansion of the hose and the anti-drainage device of the nozzle, as well as the devices to prevent reverse flow to the meter.

This test shall be carried out in accordance with the provisions of the version of Recommendation OIML R 117 in force at the time of testing.

5.3 Unit price control. This verification shall be conducted during the test at the maximum flow rate and calculated as the difference between the indicated total price and the calculated total price based on the indicated volume and the unit price.

The maximum permissible error shall be equal to the total price ± 2 % of the measured minimum amount.

5.4 Control of the emergency power supply. The correct functioning of the emergency power supply in the event of a cut in the power supply to the pump/dispenser shall be verified.

5.5 Control of the delay function for dispensers with electronic display. The delay function at the end of a transaction shall be verified in dispensers with electronic displays.

The test shall be carried out in accordance with the specific annex for initial verification of OIML R 117-2, in force.

5.6 Air removal check. The purpose of this check is to ensure that the volume of LPG in gaseous phase will not alter the accuracy of the measuring system in a new transaction.

This test shall be carried out in accordance with the provisions of the version of Recommendation OIML R 117 in force at the time of testing.

(E) Measuring systems in tankers for the supply of cryogenic liquids with a boiling point lower than 120 K (– 153 °C), for the supply of liquefied carbon dioxide and for the supply of liquefied natural gas LNG

1 Preliminary checks

1.1 Measurement standards

Weighing instruments, volumetric methods or standard meters may be used, provided that the measurement methods are consistent with the maximum permissible errors of each test. In addition, suitable supplementary devices such as flowmeters or thermometers shall be used.

The expanded uncertainty for a coverage factor of $k=2$ for measurement standards shall be less than 1/3 of the maximum permissible error in the periodic verification. If it is not possible to achieve the expanded uncertainty stated above, the reduced maximum error shall be applied.

If weighing instruments are used, the weighing tank and transfer systems shall be precooled to the temperature of the liquid to be measured to avoid the discharge of steam from the vessel being weighed.

If standard meters are used, they shall be positioned in series with the measuring system to be tested, as close as possible to that system. The shut-off valve to control the test fluid flow rate and the initiation and interruption of the flow shall be located downstream of the standard meter and shall be slowly opened and closed to avoid water hammers and pressure spikes. Avoid the creation of high points in pipes or hoses, to prevent air pockets forming, and sharp bends are not advisable.

1.2 Cable verification.

The integrity of the connecting cable(s) between the measuring sensor and the computer shall be checked.

1.3 Inspection of the piping system.

The integrity of the piping that connects the measuring system meter outlet flange and the connecting flange of the hoses or hose reels shall be checked, paying particular attention to the existence of piping or branches that allow the product already measured to be diverted or returned to the tank, to another auxiliary tank or to the circuit itself upstream of the meter. Therefore, any branches or purges that are not covered by the conformity assessment of the system shall be considered unauthorised.

Measuring systems with more than one hose. It shall be checked that while the meter is operating it is impossible to make a change to the supply conduit without the consequent termination of the supply operation. A supply operation shall be deemed to have been terminated if the indicating device has to be brought to zero to be able to perform another measurement.

1.4 Check of correct functioning of the zero-setting device.

1.5 If the meter is fitted with a receipt printer, the printing mechanism shall be associated with the zero-setting device of the volume indicator. It shall be checked that the meter and printed indications match.

1.6 Cold start and stabilisation of the system. The assembly shall be cooled for a minimum of five minutes. The assembly comprising the measuring equipment to be verified and the standard meter shall then undergo a preliminary run-in of the product at the system’s maximum flow rate for an additional minimum time of one minute.

1.7 Volume of liquid to perform the tests. Determination of the error curve of the meter shall be carried out with a volume of liquid equal to at least the minimum measured quantity.

The minimum quantity for the test shall not be less than 300 scale intervals of the meter to be verified and 1 000 scale intervals of the standard meter.

1.8 Test liquid. Verification of the system shall be carried out with the cryogenic liquid to be measured; however, another cryogenic liquid may be used provided that there is evidence of its equivalence.

2. Tests

The tests shall be carried out taking into account OIML R 81, in force, “Dynamic measuring devices and systems for cryogenic liquids” for measuring systems in tankers for cryogenic liquids with a boiling point lower than – 153 °C and in accordance with Recommendation OIML R 117, in force, “Dynamic measuring systems for liquids other than water” for the supply of liquefied carbon dioxide and for the supply of liquefied natural gas LNG and in accordance with the phases described below.

2.1 Test at 130 % of the $Q_{min}$ allowed by the system. The purpose of the test is to determine the error of the measuring system as close as possible to the $Q_{min}$ provided by the system and carried out under normal conditions of use.

2.1.1 The flow rate shall be adjusted so that its value is as close as possible to 130 % of the $Q_{min}$ allowed by the system but never lower than the value of the $Q_{min}$ marked on the data plate.

2.1.2 The system indicating device and the standard meter shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

2.1.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least three minutes.

2.1.4 The calculation of the volume measured by the standard meter shall be corrected for flow rate deviation and product temperature, provided that the equipment requires this.

2.1.5 The relative error shall be calculated as set out in Appendix I to this Annex.

The maximum permissible error in each of the tests is ± 2.5 %.

2.1.6 Steps 2.1.1 to 2.1.5 shall be repeated, calculating a total of two relative errors: er1 and er2.

2.1.7 The difference between the highest and lowest results of successive measurements shall not exceed 1 % of the measured quantity; if this requirement is not met, the entire test shall be repeated.

If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

2.2 Test at 40 % of $Q_{max}$. The purpose of this test is to determine the error of the measuring system at 40 % of the system's maximum flow rate and it shall be carried out under normal conditions of use.

2.2.1 The flow rate shall be adjusted so that its value is as close as possible to 40 % $Q_{max}$.

2.2.2 The system indicating device and the standard meter shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

2.2.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute or 500 kg.

2.2.4 The calculation of the volume or mass measured by the standard meter shall be corrected for flow rate deviation and product temperature, provided that the equipment requires this.

$V_p = K\ V_{cp}$

where $V_{cp}$ Volume indicated by the standard meter.

$K$ Correction factor of the standard meter based on the flow rate and type of product.

2.2.5 The relative error shall be calculated as set out in Appendix I to this Annex.

The maximum permissible error in each of the tests is ± 2.5 %.

2.2.6 Steps 2.2.1 to 2.2.5 shall be repeated, calculating a total of two relative errors: er1 and er2.

2.2.7 The difference between the highest and lowest results of successive measurements shall not exceed 1 % of the measured quantity; if this requirement is not met, the entire test shall be repeated.

If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

2.3 Test at 70 % $Q_{max}$ allowed by the system. The purpose of this test is to determine the error of the measuring system at 70 % of the system's maximum flow rate and it shall be carried out under normal conditions of use.

2.3.1 The flow rate shall be adjusted so that its value is as close as possible to 70 % $Q_{max}$ allowed by the system.

2.3.2 The system indicating device and the standard meter shall be set to zero (if the tester considers it appropriate, this test may be carried out after any volume without first setting the indicating device to zero).

2.3.3 Liquid shall now be passed through the measuring system at the preset flow rate for at least one minute or 500 kg.

2.3.4 The calculation of the volume or mass measured by the standard meter shall be corrected for flow rate deviation and product temperature, provided that the equipment requires this.

2.3.5 The relative error shall be calculated as set out in Appendix I to this Annex.

2.3.6 Steps 2.3.1 to 2.3.5 shall be repeated, calculating a total of two relative errors: er1 and er2.

2.3.7 The difference between the highest and lowest results of successive measurements shall not exceed 1 % of the measured quantity; if this requirement is not met, the entire test shall be repeated.

If the permissible repeatability errors are exceeded again, the system shall be deemed to have failed the test.

3 Maximum permissible errors.

3.1 For measuring systems in tankers for cryogenic liquids with a boiling point lower than – 153 °C and for the supply of liquefied natural gas (LNG).

The maximum permissible error in each of the tests is ± 2.5 %.

3.2 For liquefied carbon dioxide measuring systems.

The maximum permissible error in each of the tests is ± 1.5 %.'

Twelve. Annex VII is amended to read as follows:

## ‘ANNEX VII

## Taximeters

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of taximeters, at the phase of in-service instruments, as defined in Article 2 of Annex XIII to Royal Decree 244/2016 of 3 June 2016, in addition to their installation in the vehicle.

Section 2. Phases of State metrological control.

The State metrological control laid down in this Annex is governed by Section 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refers to the phase of instruments in service, which includes verification after repair or modification and/or periodic verification.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service taximeters is set out in Annex XIII to Royal Decree 244/2016 of 3 June 2016.

Section 4. Verification after repair or modification.

1. Verification after repair or modification of taximeters shall be carried out in accordance with Chapter III of this Order and Appendix II to this Annex.

2. The replacement of one taximeter with another in the same vehicle without changing the rest of the installation shall be regarded as a modification of the original conditions of the taximeter and it shall therefore undergo a post-modification verification in accordance with the provisions of Appendix II to this Annex. This new installation shall give rise to a new request for verification of the instrument and the action carried out shall be referred to in the request as “taximeter reinstallation”.

3. A change in fares in a taximeter shall be regarded as a modification, and a post-modification verification shall be carried out. The action carried out shall be referred to in the verification request as “fare change”. In this event, after the request for verification after repair or modification has been made, the approved metrological verification bodies shall have a maximum period of 30 working days to carry out the verification.

4. These instruments are covered by the provisions of Article 8 of this Order.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix II to this Annex.

The periodic verification period shall be one year.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix II to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

## APPENDIX I

## Specific essential requirements for taximeters

1. Definitions. In addition to the definitions laid down in Annex XIII to Royal Decree 244/2016 of 3 June 2016 on taximeters, other definitions are included here for clarification purposes.

1.1 Fare: set of economic, time and distance values that define how the taximeter calculates the cost of the service and applies, or enables the application of, supplements for additional services. There may be different fares depending on the distance and/or duration of the service, the time of day, the date or the day of the week. Fares are defined and published by the competent public authority. Each fare shall have a unique identifier.

Each fare shall have the following defined items:

– a single initial amount;

– a single amount per kilometre;

– a single hourly rate;

– supplements;

– the timetable for the application of the fare;

– the calendar of public holidays.

It is not permissible to include different values of metrological parameters in the same fare.

Notwithstanding the above, for some fares, which shall also have their identifier, the competent public authority may establish that the “service amount” corresponds to the value of the “initial amount”, so that fixed prices for certain services can be set.

In this case, the starting amount shall be charged in the fare schedule as a “set fare” and the taximeter shall allow the distance and duration of the service to continue to be measured, with these parameters being associated with a value equal to zero. The taximeter shall show the starting amount throughout the duration of the service.

1.2 Fare schedule. A set of values that are charged and applied via the taximeter and that enable the taximeter to operate based on the fares in force.

2. Maximum permissible errors. For the entire measurement, taximeter plus vehicle, the maximum permissible errors for any given distance travelled or for any given time elapsed shall not exceed the values set out below.

(a) For the time elapsed: ± 0.2 % of the real value.

(b) For the distance travelled: ± 2 % of the real value.

3. Fare structure.

3.1 The amount reflected by the taximeter in the payment position shall be the final value due for the service.

3.2 The amount corresponding to supplements may not be expressed in percentage values.

3.3 In the taxi vehicle, the fare indication shown on the external fare repeater module shall correspond to that displayed on the taximeter.

3.4 It shall not be permitted to include manual parameters referring to timetable and calendar in taximeters with time-based automatic systems that manage the entry of each fare depending on the time and date.

3.5 The initial fixed amount or fare, commonly referred to as “flag fall”, to be displayed on the taximeter, shall include all known items.

– If there is a minimum journey within the initial fixed fare, in the definition of fares, it is necessary to give the distance to be travelled from the start of the service until the taximeter registers the first fare increment or the time that must elapse from the start of the service until the taximeter registers the first increment. The indication shall be in distance if the vehicle speed is higher than the speed for fare incrementation and it shall be in time if the vehicle speed is lower than this speed.

– In the case of a “set fare”, this is deemed to be the final price at the initial fixed fare, commonly known as “flag fall”, as set out in point 1.1 above.

## APPENDIX II

## Technical test procedure for verification after repair or modification and for periodic verification of taximeters

The procedure for verification after repair or modification and for periodic verification for a taximeter shall consist of the procedures and actions set out below.

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

In both cases, the approved metrological verification body shall check the accessible part of the installation with its corresponding seals and the identification of the fare schedule. In addition, in the case of new installations, the provisions of point 1 of Appendix III to this Annex shall be checked.

2. Metrological examination. The taximeters shall continue to satisfy the essential requirements that gave rise to them being brought to market and put into service, as well as to comply with the requirements set out in Appendix I to this Annex. The examination shall be carried out in accordance with the phases set out below.

2.1 Visual inspection phase. The checks listed below shall be carried out.

(i) The taximeter shall be the one identified in the administrative examination.

(ii) The taximeter shall bear the following information on the display panel or on a clearly legible and visible plate:

(a) manufacturer name and mark;

(b) model, number and year of manufacture of the instrument;

(c) model approval mark or conformity marking;

(d) its constant *k*. If the constant *k* is not printed on the taximeter name plate, this shall be accepted provided that it can be accessed through the instrument menu.

(iii) It shall be duly sealed.

2.2 Phase of verification of the maintenance of its metrological specifications. The taximeter installed in the vehicle shall undergo verification tests in accordance with the procedure described below.

(i) Time drift: a minimum of two measurements in a single test for each fare.

(ii) Kilometre drift: a minimum of three measurements in a single test per fare at a speed above 40 km/h.

If the fare schedule version, provided by the schedule manager, is available, only one fare needs to be checked at points i and ii.

The general conditions for carrying out these tests shall be as follows.

– Temperature: between – 10 °C and + 60 °C;

– Relative humidity: up to 95 %.

The maximum permissible errors are those set out in point 2 of Appendix I to this Annex.

2.3 Verification of other requirements.

The requirements set out in point 3 of Appendix I to this Annex shall be checked.

APPENDIX III

## Requirements for the installation of taximeters

1. When the taximeter is installed in a vehicle for taxi services, it shall be ensured that the tachometric signal is taken at the correct point with an appropriate interface that avoids tampering with or intervention in any element or system of the vehicle during installation or repair of the taximeter, maintaining the maximum metrological guarantees and sealing of the interface. To meet this condition, the taximeter shall be installed in the vehicle in accordance with the provisions of the Vehicle Modifications Manual.

If a modification has been processed due to the new installation of a taximeter in a vehicle, the approved metrological verification body shall, as part of the administrative examination set out in Appendix II to this Annex, check the entry of the modification in the vehicle documentation at the first verification after the modification.

In these cases, during both the first and subsequent verifications, the holder of the installation shall make the documentation for the said modification available to the approved metrological verification body.

If the installation has been carried out in accordance with the vehicle manufacturer's instructions, the approved metrological verification body shall, as part of the administrative examination set out in Appendix II to this Annex, check the existence of the certificate attesting to the above issued by the repairer during the first verification carried out after installation.

2. For metrological purposes, connections associated with the operation of the taximeter shall be considered to be part of the taximeter.

3. The taximeter installation, from the signal pick-up to the taximeter and the multiple fare repeater module, shall not contain any elements that are foreign to the taximeter and shall be continuous and non-detachable at all times, with seals ensuring metrological control of the instrument.

4. Once a repairer has installed the taximeter in a taxi in accordance with the provisions of point 1 of this Appendix, it shall be programmed with the fares in force.

5. The fare schedule officially approved by the public authority responsible for taxi fares shall be identified directly on the taximeter and its schedule version position entered. This identification shall be provided, by means of a self-declaration, to the competent public authorities, by the person responsible for the fare schedule.

6. At the first installation of a taximeter in a taxi service vehicle, the repairer shall calculate the correct value of the instrument constant *k*, in pulses per kilometre, with a maximum tolerance of ± 0.5 %. This constant may be recalculated if the dimensional specifications of the tyres change or in exceptional cases with good reason and it shall subsequently pass a post-repair verification.

7. The characteristic coefficient of the vehicle *w*, in pulses per kilometre, shall be determined by the repairer who carries out the installation taking into account the conditions listed below.

(i) The tyres of the taxi service vehicle shall be the ones on the vehicle and they shall have an effective circumference *u*. They shall be in good condition and inflated to the correct pressure.

(ii) The load of the vehicle shall be 225 kg ± 30 kg.

(iii) The vehicle shall be driven using its motor across flat, horizontal terrain in a straight line at a speed of 40 km/h ± 5 km/h, or on a correctly calibrated roller bed.

8. Where the tests are carried out under conditions other than those set out in point 7 of this Appendix, the results shall be modified, with the necessary corrections, to bring their value to that which would have been obtained had they been carried out under the conditions laid down.'

Thirteen. Annex XI shall read as follows:

**'ANNEX XI**

**Temperature recorders and thermometers**

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of the instruments used to measure and/or record the temperature used in the transport, storage, distribution and control of temperature-controlled products in accordance with the regulatory provisions, hereinafter referred to as temperature recorders and thermometers.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service temperature recorders and thermometers is set out in Chapter II of this Order.

The temperature recorders and thermometers covered by this Order shall comply with the common essential requirements for applicable measuring instruments set out in Annex II to Royal Decree 244/2016 of 3 June 2016. Instruments that do not use

electronic devices shall be exempt from the common requirements for electronic instruments.

In addition, they shall comply with the specific requirements set out in Appendix I to this Annex.

The tests to be carried out for the conformity assessment shall be as set out in Appendix II to this Annex.

The modules to be used for the conformity assessment of temperature recorders and thermometers shall be chosen by the manufacturer from among the following options:

(a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;

(b) Module B, type examination, plus Module F, type conformity based on instrument verification;

(c) Module G, conformity based on unit verification.

For temperature recorders designed as two dissociable and interchangeable units, reading equipment and sensor, in the event all the metrological temperature measurement parameters are on the sensor, the conformity assessment certificate by type examination Module B shall specify how this interchangeability is performed and how Modules F or D are to be performed.

Section 4. Verification after repair or modification.

Verification after repair or modification of temperature recorders or thermometers shall be carried out in accordance with Chapter III of this Order and the provisions of Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

For temperature recorders with two dissociable and interchangeable units, each dissociable element shall be labelled.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix III to this Annex.

The periodic verification period shall be two years.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix III to this Annex.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

APPENDIX I

**Specific essential requirements for temperature recorders and thermometers**

The specific essential metrological and technical requirements to be met by the instruments are:

– for temperature recorders, those specified in Section 5 of UNE-EN 12830:2019 “Temperature recorders for the transport, storage and distribution of temperature sensitive goods – Tests, performance, suitability”;

for thermometers, those specified in Section 4 of EN 13485:2023 “Thermometers for measuring the ambient or internal temperature for the transport, storage and distribution of temperature sensitive goods. Tests, performance, suitability” or its UNE version.

APPENDIX II

**Technical test procedure for conformity assessment of temperature recorders and thermometers**

Conformity assessment of temperature recorders and thermometers with regard to the requirements applicable to them shall be carried out in accordance with the provisions of Article 3 of this Annex.

1. Modules B and G. The tests to be carried out and satisfactorily passed by the instrument are those in Table 1, which refers to various sections of the Standards UNE-EN 12830:2019 and EN 13485:2023.

Table 1. Sections of the standards

| Tests | Static installation | Transport | Section of UNE-EN 12 830 | Section of EN 13485 |
|---|---|---|---|---|
| Determination of error in temperature measurement | + | + | 6.3 | 5.3 |
| Determination of response time | + | + | 6.4 | 5.4 |
| Determination of error in weather recording(1) | + | + | 6.5 | - |
| Variation in supply voltage(2) | + | + | 6.6.2 | 5.5.2 |
| Electrical safety(2) | + | + | 6.6.8 | 5.5.8 |
| Dielectric strength(2) | + | + | 6.6.9 | 5.5.9 |

| | | | | |
|---|---|---|---|---|
| Influence of ambient temperature | + | + | 6.6.3 | 5.5.3 |
| Temperature test in storage and transport conditions | + | + | 6.6.4 | 5.5.4 |
| Shock resistance[3] | | + | 6.6.5 | 5.5.5 |
| Mechanical vibrations | | + | 6.6.6 | 5.5.6 |
| Protection grades afforded by the casing | + | + | 6.6.7 | 5.5.7 |
| Electromagnetic compatibility (EMC) [2][4] | + | + | - | - |
| Software testing[2] | + | + | 6.7 | - |

[1] Only in temperature recorders.
[2] If applicable.
[3] In thermometers, only for fixed thermometers.
[4] The recorder or thermometer shall comply with the requirements of Standards UNE-EN 61000-6-3/A1. "Electromagnetic compatibility (EMC). Part 6-3: Generic standards. Emission standard for residential, commercial and light-industrial environments" and UNE-EN 61000-6-1. "Electromagnetic compatibility (EMC). Part 6-1: Generic standards. Immunity standard for residential, commercial and light-industrial environments", (IEC 61000-6-1:2005) or equivalent in force and any other specific standard where applicable.
+ Apply the corresponding test.

In the type examination, the specifications of all the possible elements that make up the whole chain of measurement shall be specified.

The maximum permissible errors in the tests inherent in the type examination shall be those set out in paragraph 4.8.2 of EN 13485:2023 for thermometers and paragraphs 5.10.2.1 and 5.10.2.4 of UNE-EN 12830:2019, for temperature recorders, which are shown in the following tables.

Table 2. Accuracy classes for temperature recorders according to UNE-EN 12830:2019 and thermometers in accordance with EN 13485:2023

| **Class** | **0.2** | **0.5** | **1** | **2** |
|---|---|---|---|---|
| Maximum permissible errors | ± 0.2 °C. | ± 0.5 °C. | ± 1 °C | ± 2 °C |
| Resolution | < 0.1 °C | < 0.2 °C | ≤ 0.5 °C | ≤ 1 °C |

Table 3. Thermometer accuracy classes for measuring air temperature in accordance with UNE-EN 13485:2002

| **Class** | **1** | **2** |
|---|---|---|
| Maximum permissible errors | ± 1 °C | ± 2 °C |
| Resolution | 0.5 °C | 1 °C |

Table 4. Thermometer accuracy classes for measuring the internal temperature of the product in accordance with UNE-EN 13485:2002

| Class | 0.5 | 1 |
|---|---|---|
| Maximum permissible errors | 0.5 °C | 1 °C |
| Resolution | 0.1 °C | 0.5 °C |

Table 5. Maximum relative error for temperature recorders

| Maximum relative error of time |
|---|
| 0.1 % of the duration of the recording for durations of up to 31 days. |
| 0.02 % of the duration of the recording, including date and time error, for durations of more than 31 days. |

Every temperature recorder and thermometer manufactured under a type examination certification, and its sensors, shall bear the particulars set out in Section 8 of Standards UNE-EN 12830:2019 and EN 13485:2023 for temperature recorders and thermometers, respectively.

2. Modules F and D.

For instruments with type examination prior to the entry into force of this Order amending Order ICT155/2020 of 7 February 2020:

The tests to be carried out and passed satisfactorily by the instrument are those set out in Section 5.3 of UNE-EN 13485.2002 for thermometers and Sections 6.3 and 6.5 of UNE-EN 12830:2019 for temperature recorders, as well as the correct marking and sealing defined in the corresponding type examinations. In the case of recorders, for the test to determine the error in time recording, Section 6.5 of UNE-EN 12830:2019 shall be followed, with the test being carried out only at the temperature corresponding to normal or average operating conditions.

The maximum permissible errors in the tests are those set out in UNE-EN 13485:2002 for thermometers and in UNE-EN 12830:2019 for temperature recorders (see Tables 2, 3, 4 and 5 of this Appendix). The correct functioning of all data display, printing and downloading devices associated with the recorder and listed in the type examination shall be checked.

For instruments with type examination after the entry into force of this Order amending Order ICT155/2020 of 7 February 2020:

The tests to be carried out and passed satisfactorily by the instrument are those set out in Section 5.3 of EN 13485:2023 for thermometers and Sections 6.3 and 6.5 of UNE-EN 12830:2019 for temperature recorders, as well as the correct marking and sealing defined in the corresponding type examinations. In the case of recorders, for the test to determine the error in time recording, Section 6.5 of UNE-

EN 12830:2019 shall be followed, with the test being carried out only at the temperature corresponding to normal or average operating conditions.

The maximum permissible errors in the tests are those set out in EN 13485:2023 for thermometers and in UNE-EN 12830:2019 for temperature recorders (see Tables 2 and 5 of this Appendix). The correct functioning of all data display, printing and downloading devices associated with the recorder and listed in the type examination shall be checked.

Once the tests for this module have been carried out with a satisfactory result, in the case of instruments requiring subsequent installation for which a seal has to be removed and reaffixed without modification of the initial connection, the authorised repairer or manufacturer shall check the correct functioning of the instruments after installation and affix the seals removed. The type examination shall state which seals may be removed during installation without requiring subsequent post-repair verification. If, in addition, the installation involves making changes to the connection or the installation of new conductors covered by the relevant type examination between the temperature sensors and the reading equipment, with respect to the assembly that has been tested, the post-modification verification tests described in Appendix III to this Annex shall be carried out.

In addition, the application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of partial or complete conformity to the essential requirements.

## APPENDIX III

### Technical test procedure for verification after repair or modification and for periodic verification of temperature recorders and thermometers

The procedure for verification after repair or modification and for periodic verification for a temperature recorder or thermometer shall consist of the procedures and actions set out below.

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

2. Metrological examination.

For instruments with type examination prior to the entry into force of this Order amending Order ICT155/2020 of 7 February 2020:

The tests for periodic verification and verification after repair or modification are those set out in UNE-EN 13486:2002. “Temperature recorders and thermometers for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream. Periodic verification”.

The maximum permissible errors for periodic verification and for verification after repair or modification are those set out in UNE-EN 13485:2002 for thermometers and in UNE-EN 12830:2019 for temperature recorders (see Tables 2, 3, 4 and 5 of Appendix II to this Annex).

For instruments with type examination after the entry into force of this Order amending Order ICT155/2020 of 7 February 2020:

The tests for periodic verification and verification after repair or modification are those set out in Standard EN 13486:2023. “Temperature recorders and thermometers for measuring the ambient or internal temperature for the transport, storage and distribution of temperature sensitive goods – Periodic verification”.

The maximum permissible errors for periodic verification and for verification after repair or modification are those set out in EN 13485:2023 for thermometers and in UNE-EN 12830:2019 for temperature recorders (see Tables 2 and 5 of Appendix II to this Annex).

The temperature recorder or thermometer shall comply with the maximum permissible errors for the class shown on its data plate. In no case shall a periodic verification or a verification after repair or modification be considered successful for a class other than the class of the marking.

In addition, the application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of partial or complete conformity to the essential requirements.

In the case of temperature recorders, if, during the periodic verification or the verification after repair or modification, the recorder time lag exceeds two hours, the verification shall be deemed unfavourable.’

Fourteen. The third point of Section (A) of Appendix II to Annex XII is amended to read as follows:

‘For the purpose of carrying out the speed and distance simulation tests, if applicable, the manufacturer shall provide a simulation set appropriate to each type of kinemometer that shall be equipped with information outputs or information ports of the type CAN bus, RS 232 or similar ports, with the possibility of transmitting the

information by radio to the verification centre for comparison. If the manufacturer is unable to provide the simulation set, for technically justified reasons, the tests may be replaced by tests on circuits with measured speeds of up to 250 km/h.'

Fifteen. Subsection 3.2 of Appendix I to Annex XV is amended to read as follows:

'3.2 Hysteresis error. The absolute value of the maximum permissible error for temperatures between 15 °C and 25 °C, as set out in Table 1 of this Appendix, shall not be exceeded.'

Sixteen. Annex XVI is amended to read as follows:

'**ANNEX XVI**

**Instruments for measuring the sugar content of grape must, concentrated musts and rectified concentrated musts**

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of instruments for measuring the sugar content of grape must, concentrated musts and rectified concentrated musts, hereinafter called refractometers.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service refractometers is set out in Chapter II of this Order.

The refractometers covered by this Order shall comply with the common essential requirements for applicable measuring instruments set out in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I to this Annex.

The modules to be used for the conformity assessment of refractometers shall be chosen by the manufacturer from among the following options:

(a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;

(b) Module B, type examination, plus Module F, type conformity based on instrument verification;

(c) Module H1, conformity based on full quality assurance plus design examination.

The application of test programmes in accordance with Recommendation OIML R 124 shall provide presumption of conformity with the essential requirements. “Refractometers for the measurement of the sugar content of grape must”, in force, or with the guidelines of the High Council of Metrology or the guides of the Legal Metrology Commission.

The maximum permissible errors and the tests to be carried out for the conformity assessment shall be those set out in Appendix I and Appendix II to this Annex respectively.

Section 4. Verification after repair or modification.

Verification after repair or modification of refractometers shall be carried out in accordance with Chapter III of this Order and Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix III to this Annex.

The periodic verification period shall be one year.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix III to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

## APPENDIX I

## **Specific essential requirements for refractometers**

1. Requirements.

1.1 The metrological and technical requirements to be met by refractometers used to determine the sugar content of grape must, concentrated musts and rectified concentrated musts are those established in the normative document OIML R 124,

“Refractometers for the measurement of the sugar content of grape must”, except as specifically provided for in this Annex.

2. Types of instruments.

2.1 Automatic refractometer (Type I). Refractometer equipped with:

(a) an automatic temperature correction device;

(b) an indicating device visible to all interested parties at the same time;

(c) a zero-setting device or a device to adjust to a point of the scale other than zero;

(d) a zero-checking device;

(e) an automatic cleaning device.

2.2 Manual refractometer with automatic indication (Type II): Refractometer equipped with:

(a) an automatic temperature correction device;

(b) an indicating device visible to all interested parties at the same time;

(c) a zero-setting device or a device to adjust to a point of the scale other than zero;

(d) a zero-checking device.

3. Operating conditions.

3.1 Environmental conditions. Temperature range from 5 °C to 40 °C.

3.2 Mechanical environment. The applicable mechanical environment class shall be M1.

3.3 Electromagnetic environment. The electromagnetic environment class shall be E2.

4. Maximum permissible errors. The maximum permissible error applies to the indications without rounding.

4.1 Maximum permissible errors for new or repaired refractometers. The maximum permissible error for each scale shall be:

– Refractive index scale: ± 1 interval.

– Brix scale: ± 1.2 interval.

– Probable alcohol scale: ± 0.8 interval.

4.2 Maximum permissible errors for instruments in service.

– Refractive index scale: ± 1.5 interval.

– Brix scale: ± 1.7 interval.

– Probable alcohol scale: ± 1.3 interval.

5. Technical requirements.

5.1 Scale interval.

5.1.1 Scale interval. In accordance with the measure used to express the result of the measurement, the interval in normal usage mode shall be equal to:

– $2 \times 10^{-4}$ for the refractive index;

– 0.1 % for the mass fraction of a sucrose solution (ºBrix);

– 0.1 % for the probable alcohol content.

5.1.2 Verification interval The refractometer shall incorporate a method to increase the resolution of the instrument by one digit. The process of changing between verification intervals shall be documented in the instructions for the instrument and it shall not be possible to apply this process during normal operation of the instrument.

5.2 Indicating device.

5.2.1 Type I refractometer. The indicating device shall contain a numerical indication. On the indicating device, the figures shall be 2.5 cm high for luminous characters and 3 cm for the rest.

Rounding shall be to the nearest normal interval.

5.2.2 Type II refractometer. The indicating device shall meet the same requirements as for Type I refractometers, except for the height of the figures, which shall be at least 0.5 cm.

5.2.3 Indication. When the fluid is not in contact with the optical surfaces of the refractometer, the instrument shall not give a result, except when the sample is dynamic when the result shall be shown for a maximum of one minute after passage of the sample has been completed.

5.3 Printer. Refractometers can be fitted with a device that prints out the results in the form of aligned figures.

The print-out shall be a replica of the value and unit presented by the indicating device.

Printing shall not be possible before the end of the measurement.

5.4 Zero-setting device and zero-checking device. Zero-setting and zero-checking devices are mandatory for all types of refractometers. These devices shall be simple and have a virtually continuous effect.

For zero-checking, the refractometer shall have a scale with a normal and graduated interval range in quarter intervals on both sides of zero. The zero-setting and zero-checking shall be carried out with uncertainty of less than or equal to a quarter of an interval and there shall be a system that highlights any deviation greater than one interval.

If the refractometer has a device to adjust to a point on the scale that does not correspond to zero, the refractometer shall prevent measurement in the event of malfunction (detection of an error of more than one interval).

It shall be possible to differentiate between automatic control operations and measuring operations, with the zero-setting device being mandatory for each instrument.

In the case of non-automatic devices, the zero-checking device shall be difficult to access; its use shall require a tool to prevent tampering.

At the phase of bringing to market and putting into service, the zero drift for four hours, in conditions of normal use, shall be less than half an interval.

For both the verification after repair or modification and the periodic verification, the zero drift for 30 minutes, in conditions of normal use, shall be less than half an interval.

5.5 Measuring range. For the quantity considered, the minimum measuring range shall include the range corresponding to the values of 10 % to 30 % in mass fraction of a sucrose solution.

5.6 Temperature correction device. The refractometer shall be equipped with a device so that the refractometer reading corresponds to the reading obtained at the reference temperature of 20 ºC.

The temperature scale shall have a measuring range of at least 5 °C to 40 °C. If the temperature range specified for the correction device is exceeded, an automatic device shall show this.

If the temperature of the upper or lower limit of the operating range of the equipment is exceeded, the refractometer shall show this.

5.7 Sampling device. For Type I refractometers, the sample used for the measurement shall meet the conditions set out below.

5.7.1 Static fluid. When the must is stationary during the measurement, the receptacle shall have a minimum content of 20 cl.

5.7.2 Dynamic fluid. When the must is in flow during measurement, the result of the measurement shall be representative of a sample with a volume of at least 30 cl.

5.8 Cleaning. After each measurement, the optical surfaces of the refractometer in contact with the measured fluid and, if appropriate, the passageways for the fluid, shall be cleaned effectively and without deterioration of the instrument.

For Type I refractometers, the cleaning shall be automatic.

5.9 Expression of results. The measurement result may be expressed in one of the following forms:

(a) value of the refractive index (nD); or

(b) value of the mass fraction of a solution of sucrose having the same refractive index (ºBrix); or

(c) probable alcohol content (% vol.) based on a sugar concentration of 16.83 g/L.

6. Suitability. Refractometers shall be made with materials that ensure sufficient solidity and stability for their use. In particular, the parts in contact with grape must shall be manufactured from materials that are not affected by this.

## APPENDIX II

## Technical test procedure for conformity assessment of refractometers

Conformity assessment of refractometers with regard to the requirements applicable to them shall be carried out in accordance with the provisions of Article 3 of this Annex.

1. Refractometer type examination (Module B). The type examination of refractometers shall be carried out in accordance with Article 5 of Annex I to Royal Decree 244/2016 of 3 June 2016.

The tests to be carried out shall be those set out in Recommendation OIML R 124 and in accordance with the provisions of OIML D 11 “General requirements for measuring instruments. Environmental conditions”.

In addition, the following considerations shall be taken into account.

1.1 Laboratory testing under nominal conditions.

1.1.1 Calibration curve. For the quantity considered, at least five points shall be determined that shall be evenly distributed along the measuring range of the instrument for each of the scales available on that instrument.

The result of the measurement may be expressed as:

(a) value of the refractive index; or

(b) value of the mass fraction of a solution of sucrose having the same refractive index (ºBrix); or

(c) probable alcohol content (% vol.) based on a sugar concentration of 16.83 g/L.

The maximum permissible errors are those set out in point 4.1 of Appendix I to this Annex.

1.1.2 Repeatability. Ten consecutive measurements shall be performed at the midpoint of the minimum measuring range of the instrument.

The experimental standard deviation obtained shall be less than or equal to 0.013 interval.

1.1.3 Temperature correction device. For the quantity considered, three points shall be determined, evenly distributed over the measuring range of the instrument.

For each of these points, measurements shall be taken at the following temperatures:

– reference temperature of 20 °C ± 0.5 °C;

– temperature of the upper limit of the equipment operating range;

– temperature of the lower end of the equipment operating range.

The difference between the measurements taken at any temperature and those carried out at the reference temperature of 20 °C ± 0.5 °C shall not exceed one interval.

If the temperature of the upper or lower limit of the operating range of the equipment is exceeded, the instrument shall show this.

1.1.4 Zero drift. At the phase of bringing to market and putting into service, the zero drift over four hours, in conditions of normal use, shall be less than half an interval.

1.2 Influence factor and disturbance tests. The test procedures described below shall be in accordance with the versions in force of the internationally approved normative documents or harmonised standards. All these tests shall be carried out with the refractometer in operating conditions.

During these tests, refractometers shall either:

(i) function correctly and comply with the maximum permissible errors;

(ii) not show an indication of the result of the measurement, returning to normal after the test.

The difference between the highest and lowest readings shall not exceed the maximum permissible error set out in point 4.1 of Appendix I to this Annex.

1.2.1 Ambient temperature test (climatic environment).

(a) Dry heat. As set out in document OIML D 11.

(b) Cold. As set out in document OIML D 11.

The maximum permissible errors are those set out in point 4.1 of Appendix I to this Annex.

1.2.2 Tests in mechanical environment. Mechanical shocks. The conditions corresponding to severity level 2 in accordance with section B.5 of document OIML D 11 shall be applied.

1.2.3 Electrical disturbance tests.

(a) Variations in supply voltage. Applicable standard: UNE-EN 61000-4-11. “Electromagnetic compatibility (EMC). Part 4-11: Testing and measurement techniques. Immunity tests for voltage dips, short interruptions and voltage variations”, in force.

(b) Electrostatic discharges. Applicable standard: UNE-EN 61000-4-2. “Electromagnetic compatibility (EMC). Part 4-2: Testing and measurement techniques. Electrostatic discharge immunity test”, in force.

(c) Electrical bursts. Applicable standard: UNE-EN 61000-4-4. “Electromagnetic compatibility (EMC). Part 4-4: Testing and measurement techniques. Electrical fast transient/burst immunity test”, in force.

(d) Dips and interruptions. Applicable standard: UNE-EN 61000-4-11, in force.

One measurement shall be carried out before and another during the application of the field.

1.3 Cleaning effect test. To ensure the instrument cleaning device is correctly checked, this test shall be carried out with grape must.

Measurements shall be carried out under the following equipment operating conditions:

– normal conditions of use of pneumatic air pressure and water pressure;

– normal water pressure and minimum air pressure;

– normal air pressure and minimum water pressure;

– minimum operating conditions for both air and water pressure.

It shall be checked that the differences between the measurements with the equipment in its the normal operating state and when subjected to each of these conditions do not exceed one interval.

2. Tests for conformity assessment (Modules D and F). These tests shall consist of checking the conformity of the refractometer with the type and passing the tests described in points 1.1.1, 1.1.3 and 1.1.4 of this Appendix under the nominal conditions.

3. Tests for conformity assessment (Module H1). The design examination applied to refractometers shall demonstrate compliance with the requirements set out in Appendix I to this Annex.

Tests for conformity assessment based on full quality assurance applied to refractometers shall be carried out in accordance with points 1.1, 1.2 and 1.3 of this Appendix.

## APPENDIX III

## Technical test procedure for verification after repair or modification and for periodic verification of refractometers

The procedure for verification after repair or modification and for periodic verification for a refractometer shall consist of the procedures and actions set out below.

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

2. Metrological examination. The refractometers shall continue to satisfy the essential requirements that led to them being brought to market and put into service. In particular, compliance with the requirements set out in Appendix I to this Annex shall be checked.

For verification after repair or modification and for periodic verification, the calibration curve according to point 1.1.1 of Appendix II to this Annex shall be produced.

For both the verification after repair or modification and the periodic verification, the zero drift over 30 minutes, in conditions of normal use, shall be less than half an interval.

Verification after repair or modification and periodic verification shall require, on the part of the approved metrological verification body or the competent public authority, the availability of the resources set out in point 1 of Appendix IV to this Annex.

Presumption of conformity with the essential requirements shall be provided by the implementation of test programmes in accordance with Recommendation OIML R 124, or the guidelines of the High Council for Metrology or the guides of the Legal Metrology Commission.

The maximum permissible errors are those set out in point 4 of Appendix I to this Annex.

2.1 General requirements for conducting tests. All tests shall be carried out under the rated operating conditions described in the mandatory information and established by the manufacturer in the technical documentation associated with the conformity assessment procedure applied for bringing to market and putting into service.

APPENDIX IV

## Reference materials

1. Reference working materials for refractometer tests. The reference materials listed below shall be used.

1.1 Certified sucrose reference material solutions prepared by weighing. Accuracy class I scales, in accordance with Annex I to this Order, shall be used to make these solutions.

Scales of this class with an interval of 1 mg enable solutions to be obtained with a mass fraction of a sucrose solution with an uncertainty of 0.02 % when the mass of the solution exceeds 10 g, when the measurements are taken under reference conditions and considering air buoyancy.

These reference materials shall be certified by one of the following:

(a) the Spanish Metrological Centre or another National Metrological Institute that is a signatory of the Mutual Recognition Agreement;

(b) an approved laboratory, as an entity certifying the reference material.

1.2 Glucose or sucrose reference material solutions whose concentration shall be determined by a reference refractometer traceable to certified sucrose solutions.

The reference refractometer shall:

– have a resolution of 0.01ºBrix;

– have a temperature correction device;

– be calibrated at 20 °C with certified sucrose solutions as reference materials with an error plus calibration uncertainty of less than one third of the maximum permissible error for the refractometer.

1.2.1 Sucrose solutions. If the mass fraction of the sucrose solution is determined at a temperature other than 20 °C, the corrections given in Table 1 shall be applied.

1.2.2 Glucose solutions. Glucose solutions whose mass fraction is determined based on the refractive index at 20 °C obtained by the reference refractometer may be used.

In this case, if the temperature of the glucose solution is not 20 °C, the values in Table 1 need to be multiplied by 1.3.

The glucose solutions shall have a mass fraction with a relative uncertainty of less than 0.06 %.

Table 1. Corrections to the concentration of sucrose at temperature

| Temperature ºC | Sucrose in grams per 100 g of product | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 75 |
| | Subtract | | | | | | | | | |
| 15 | 0.25 | 0.27 | 0.31 | 0.31 | 0.34 | 0.35 | 0.36 | 0.37 | 0.36 | 0.36 |
| 16 | 0.21 | 0.23 | 0.27 | 0.27 | 0.29 | 0.31 | 0.31 | 0.32 | 0.31 | 0.23 |
| 17 | 0.16 | 0.18 | 0.20 | 0.20 | 0.22 | 0.23 | 0.23 | 0.23 | 0.20 | 0.17 |
| 18 | 0.11 | 0.12 | 0.14 | 0.15 | 0.16 | 0.16 | 0.15 | 0.12 | 0.12 | 0.09 |
| 19 | 0.06 | 0.07 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.08 | 0.07 | 0.05 |
| | Add | | | | | | | | | |
| 21 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 22 | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| 23 | 0.18 | 0.20 | 0.20 | 0.21 | 0.21 | 0.21 | 0.21 | 0.22 | 0.22 | 0.22 |
| 24 | 0.24 | 0.26 | 0.26 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.29 | 0.29 |
| 25 | 0.30 | 0.32 | 0.32 | 0.34 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.37 |

2. Relationship between the refractive index and the mass fraction of a sucrose solution. The mass fraction of sucrose of a solution in distilled water ($W_B$), also known as ºBrix, is the quotient of the mass of chemically pure sucrose contained in the solution to the total mass thereof.

By convention, the sugar percentage of a must, expressed in %, is equal to the percentage of a distilled water sucrose solution, taking into account the refractive index, at a temperature of 20 °C and for a wavelength of 589 nm.

The ratio of the mass fraction of a sucrose solution, $W_B$, expressed in % (0 %< $W_B$ < 85 %) and the vacuum refractive index of this solution, $n_v$, at a temperature of 20 °C and for a wavelength of 589 nm is given by the formula:

$$n_v = A_0 + A_1 \times W_B + A_2 \times W_B^2 + A_3 \times W_B^3 + A_4 \times W_B^4 + A_5 \times W_B^5$$

where:

$A_0 = + 1.3333488$

$A_1 = + 1.428372 \times 10^{-3}$

$A_2 = + 5.440473 \times 10^{-6}$

$A_3 = + 1.306219 \times 10^{-8}$

$A_4 = + 1.203625 \times 10^{-10}$

$A_5 = -8.977784 \times 10^{-13}$

The correspondence between the mass fraction and the refractive index in air, calculated based on the value established by the Edlèn formula for the air index in the reference conditions $n_a$= 1.00027191 is given by the formula:

$$n = n_v/n_a$$

3. Ratio of refractive index to probable alcohol content

3.1 For musts and concentrated musts, the ratio between the probable alcohol content expressed in % (% vol. at 20 °C) and the refractive index of this solution, n, at a temperature of 20 °C and for a wavelength of 589 nm, is given in the Resolutions of the International Organisation of Vine and Wine (OIV), in force.

3.2 For concentrated musts rectified from 50 °Brix, the ratio between the probable alcohol content expressed in percentage terms (% vol. at 20 °C) and the refractive index of this solution, n, at a temperature of 20 °C and for a wavelength of 589 nm, is given by the formula:

$$y = 193.959\ n^2 - 109.023\ n - 199.030$$

## APPENDIX V

## Conditions to be met by refractometers in service before 24 October 2007 to be able to be submitted to the metrological control phase of periodic verification

1. It shall be certified that the date of instrument commissioning is prior to 24 October 2007.

2. The refractometer shall be identifiable, with at least a serial number.

3. The refractometer shall be sealed.

4. The refractometer shall indicate the measurement result in any of the following ways:

(a) value of the refractive index (nD); or

(b) value of the mass fraction of a solution of sucrose having the same refractive index (ºBrix); or

(c) probable alcohol content (% vol.).

5. In accordance with point 5.1.2 of Appendix I to this Annex, refractometers that do not provide the possibility for reading in interval mode of verification shall be subject to the maximum permissible errors set out in point 4 of that Appendix.

6. They shall have automatic reading and temperature correction at 20 °C.

7. To obtain 1 % vol. of probable alcohol, the basis for the calculation shall be a sugar content of between 16.5 g/L and 17.5 g/L.

The concentration in grams of sugar per litre of grape must shall be obtained from the refractive index *n* of the must through the formulae set out in Recommendation OIML R-124:

$\rho B = 6844\ (n - 1.3358)$ for $n \leq 1.3706$;

$\rho B = 6712\ (n - 1.3351)$ for $n > 1.37068$.

Instruments that pass the periodic verification shall have, both on the certificate of verification and on the instrument itself, the wording “Expression of the result verified in [verified scale(s)] on [verification date]. The Baumé scale is not covered by the metrological control carried out”.’

Seventeen. Annex XVII is amended to read as follows:

‘**ANNEX XVII**

**Meters installed in Type B and C amusement and gaming machines.**

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of meters installed in Type B and C amusement and gaming machines, hereinafter referred to as amusement machine meters, and in their ancillary equipment.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service amusement machine meters is set out in Chapter II of this Order and the tests set out in Appendix II to this Annex shall be carried out.

The amusement machine meters covered by this Order shall comply with the common essential requirements for applicable measuring instruments set out in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I to this Annex.

The module to be used to carry out conformity assessment of amusement machine meters shall be:

(a) Module A2, internal production control plus supervised instrument control at random intervals.

The application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of conformity to the essential requirements.

Section 4. Verification after repair or modification.

Verification after repair or modification of amusement machine meters shall be carried out in accordance with Chapter III of this Order and Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix III to this Annex.

The periodic verification period shall be four years.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix III to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

APPENDIX I

**Specific essential requirements for amusement machine meters**

1. Definitions. The meter designed to be incorporated into an amusement machine shall be a compact assembly that guarantees inviolability, suitable for testing independently from the rest of the system and it shall perform at least the following functions:

(a) detection of suitable electric pulses and translation, if applicable, of these in accordance with the requirements of the meter technology;

(b) aggregation or modification of the status of the meter and recording or storing of the accumulated data.

2. Operating conditions.

2.1 Environmental conditions.

2.1.1 The temperature range shall be from – 10 °C to + 40 °C.

2.1.2 The minimum and maximum storage temperatures, or when the instrument is out of service, shall be – 10 °C and + 55 °C, respectively.

2.1.3 Amusement machine meters shall withstand damp conditions with or without condensation depending on the operating climatic environment and their intended location.

2.1.4 The applicable mechanical environment class is M1, as set out in Annex II to Royal Decree 244/2016 of 3 June 2016.

2.1.5 The applicable electromagnetic environment class is E1, as set out in Annex II to Royal Decree 244/2016 of 3 June 2016.

3. Maximum permissible errors *(mpe*). The maximum permissible error *(mpe*) shall be calculated as the percentage of faults in the indications regulated by the amusement machine meter.

3.1 Conformity assessment and verification after repair or modification. The percentage of faults in the indications regulated by the amusement machine meter shall not exceed ± 0.01 %.

3.2 Periodic verification. The percentage of faults in the indications regulated by the amusement machine meter in the periodic verification shall not exceed ± 0.1 %.

4. Permitted influences on mechanical and electromagnetic disturbances.

4.1 The variation of a measurement result under the influence of mechanical and electromagnetic disturbances shall not exceed the critical variation value set out in point 4.2. of this Appendix or it shall be clearly indicated that the measurement indication is invalid or that the instrument shall cease to function.

4.2 The critical variation value is equal to *mpe* in conformity assessment.

5. Suitability.

5.1 Amusement machine meters shall be constructed in modules and designed and manufactured in such a way that, in the event of durability faults resulting from the electronic components themselves, these will be detected and exposed by means of control systems.

5.2 Due to the machine–meter communication system, there shall be an automatic two-way device so that, in the event of any anomaly, the machine will be taken out of service.

5.3 The amusement machine meter shall have totalisers, which shall exercise the function of legal control for tax purposes and prevent possible fraud. In the event of breakdown, power failure or disconnection, all recorded information shall be kept for at least 6 years.

5.4 Data from the amusement machine meter may be obtained at any time through a memory reader with direct access to the meter, with independent reading, reserved for the authority, or by means of the display of the machine when it is in service mode.

5.5 The area of the machine where the meter is located shall be sealed to prevent access from the outside to both the meter and the wires going in and out of it. If it is affixed using screws, they shall also be sealed.

5.6 Where additional resources are needed to download the software installed on the meter, they shall be supplied to the metrological control body by the manufacturer.

## APPENDIX II

## **Technical test procedure for conformity assessment of amusement machine meters**

Conformity assessment of amusement machine meters with regard to the requirements applicable to them shall be carried out in accordance with the requirements established in Section 4 of this Annex.

The tests shall be carried out on one amusement machine meter with its ancillary devices from among three to be submitted for that purpose, the remaining two being available to the assessment body for statistical analysis in the event of inconclusive results.

The above meters shall be accompanied by a simulation assembly representative of their normal operation, for example, a game simulator with its module and its corresponding interface. In the technical documentation submitted, the applicant shall provide the communication protocols between the meter–machine and the data reader–meter.

The tests are described below.

1. Verification of compliance with this Annex and the documentation provided.

2. Influence tests at the disturbances detailed below.

These test procedures shall be in accordance with the versions of the referenced standards in force at the time of testing.

– Dry heat.

Table 1. Applicable regulations for the dry heat test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-2 “Environmental tests. Part 2-2: Tests. Test B: Dry heat” and UNE-EN 60068-3-1. “Environmental tests. Part 3-1: Supporting documentation and guidance. Cold and dry heat tests. Severity level: 2”. |
| Purpose | The test consists of exposing the amusement machine meter in operating conditions to a temperature of + 40 °C for two hours. |

During and after this environmental test, the amusement machine meter shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex. The maximum permissible errors shall be checked during this test.

– Cold.

Table 2. Applicable regulations for the cold test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-1. “Environmental tests. Part 2-1. Tests Test A: Cold” and UNE-EN 60068-3-1. “Severity level: 2”. |
| Purpose | The test consists of exposing the amusement machine meter in operating conditions to a temperature of – 10 °C for two hours. |

During and after this environmental test, the amusement machine meter shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex. The maximum permissible errors shall be checked during this test.

– Damp heat.

Table 3. Applicable regulations for damp heat test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-30. “Environmental tests. Part 2.30: Tests. Test Db: Damp heat, cyclic (12 h + 12 h cycle). Severity level: 2” and UNE-EN 60068-3-4. “Environmental tests. Part 3-4: Supporting documentation and guidance. Damp heat testing. Severity level: 2”. |
| Purpose | This test consists of exposing the amusement machine meter in operating conditions to cyclical temperature variations between 25 °C and 55 °C, while keeping the relative humidity between 93 % and 95 %.<br>Two cycles of this test shall be performed. |

During and after this environmental test, the amusement machine meter shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex. The maximum permissible errors shall be checked during this test.

– Random vibrations.

Table 4. Applicable regulations for random vibration testing

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-64. “Environmental tests. Part 2-64: Tests. Test Fh: Vibration, broadband random and guidance. Severity level:1”. |
| Purpose | This test consists of making the amusement machine meter vibrate with a power supply and simulated game, sweeping the frequency in the range 10 Hz–150 Hz at root mean square (RMS) acceleration level of 1.6 $m.s^{-2}$ with an acceleration spectral density (ASD) of:<br>0.05 $m^2s^{-3}$ for 10 Hz-20 Hz.<br>– 3 dB/octave for 20 Hz-150 Hz.<br>Vibrations shall thereafter be applied along three main perpendicular axes, with a minimum duration of two minutes per axis. |

During and after this test, the amusement machine meter shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex. The maximum permissible errors shall be checked during this test.

– Mechanical shock.

Table 5. Applicable regulations for the mechanical shock test

| | |
|---|---|
| Applicable standard | Standard 60068-2-31. “Environmental tests. Tests. Test Ec: Rough handling shocks, primarily in equipment-type specimens. Severity level: 1”. |
| Purpose | This test consists of allowing the amusement machine meter to fall freely under operating conditions, on one of its edges on |

| | |
|---|---|
| | the test surface from a height of 25 mm. |

After this test, no critical fault shall occur.

– Short voltage dips and interruptions.

Table 6. Applicable regulations for testing short voltage dips and interruptions.

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-11. “Electromagnetic compatibility (EMC). Part 4-11: Testing and measurement techniques. Immunity tests for voltage dips, short interruptions and voltage variations. Severity level: 2”. |

During and after this test, no critical fault shall occur.

– Electrostatic discharges.

Table 7. Applicable regulations for the electrostatic discharge test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-2. “Electromagnetic compatibility (EMC). Part 4-2: Testing and measurement techniques. Electrostatic discharge immunity test. Severity level: 3”. |
| Purpose | The test consists of exposing the amusement machine meter in operating conditions to contact electrostatic discharges of 6 kV and airborne discharges of 8 kV. |

During and after this test, no critical fault shall occur.

– Radiated electromagnetic immunity.

Table 8. Applicable regulations for the radiated electromagnetic immunity test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-3. “Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test. Severity level: 2”. |
| Purpose | This test consists of exposing the amusement machine metering system in operating conditions to electromagnetic fields radiated in the frequency range 80 MHz to 2 000 MHz, with an electric field intensity level of 3 V/m, and an 80 % amplitude modulation, sine wave of 1 kHz. |

During and after this test, no critical fault shall occur.

– Conducted immunity.

Table 9. Applicable regulations for conducted immunity testing

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-6. “Electromagnetic compatibility (EMC). Part 4-6: Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields. Severity level: 2”. |

During and after this test, no critical fault shall occur.

– Electrical bursts.

Table 10. Applicable regulations for the electrical bursts test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-4. “Electromagnetic compatibility (EMC). Part 4-4: Testing and measurement techniques. Electrical fast transient/burst immunity test”. |
| Purpose | This test consists of exposing the amusement machine metering system in operating conditions to transient voltage bursts in the form of a double-exponential wave. Each impulse shall have a rise time of five nanoseconds and a duration at half amplitude of 50 nanoseconds.<br>The duration of the burst shall be 15 milliseconds, with a periodicity of 300 milliseconds.<br>The impulse peak amplitude shall be 1 000 V.<br>This shall be applied for the time necessary to simulate five measurement speeds, with errors within the permitted margins. |

During and after this test, no critical fault shall occur.

3. Automatic operation tests. A sufficient number of simulated games shall be performed to check the entire operation of the amusement machine meter in all its modes.

The maximum permissible errors *mpe* are those set out in point 3.1 of Appendix I to this Annex.

## APPENDIX III

## **Technical test procedure for verification after repair or modification and for periodic verification of amusement machine meters**

The procedure for verification after repair or modification and for periodic verification for an amusement machine meter shall consist of the procedures and actions set out below.

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

2. Metrological examination. The amusement machine meters shall continue to satisfy the essential requirements that led to them being brought to market and put into service. In particular, the correct installation and adjustment of the instrument shall be checked to ensure the essential metrological and technical requirements of Appendix I to this Annex are met.

The maximum permissible errors *mpe* are those set out in point 3 of Appendix I to this Annex.

2.1 General requirements for conducting tests. All tests shall be carried out under the rated operating conditions described in the mandatory information and established by the manufacturer in the technical documentation associated with the conformity assessment procedure applied for bringing to market and putting into service.

2.2 Checking correct installation. The installation of the meter in the machine shall be checked to ensure the essential requirements established in Appendix I to this Annex are met.

2.3 Checking instrument accuracy. The instrument shall undergo at least 20 game play tests or until a prize is won to verify compliance with the maximum permissible errors set out in Appendix I to this Annex.'

Eighteen. Annex XVIII is amended to read as follows:

**'ANNEX XVIII**

**Systems for counting and monitoring the flow of people in public premises**

Section 1. Purpose.

The purpose of this Annex is to regulate State metrological control of systems for counting and monitoring the flow of people in public premises to be determined by the competent public authority, hereinafter referred to as people counting systems.

Section 2. Phases of State metrological control.

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. Conformity assessment phase.

The applicable conformity assessment phase for bringing to market and putting into service people counting systems is set out in Chapter II of this Order and the tests set out in Appendix II to this Annex shall be carried out.

The people counting systems covered by this Order shall comply with the common essential requirements for applicable measuring instruments set out in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I to this Annex.

The modules to be used for the conformity assessment of people counting systems shall be chosen by the manufacturer from among the following options:

(a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;

(b) Module B, type examination, plus Module F, type conformity based on instrument verification;

(c) Module H1, conformity based on full quality assurance plus design examination.

The application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of conformity to the essential requirements.

Section 4. Verification after repair or modification.

Verification after repair or modification of people counting systems shall be carried out in accordance with Chapter III of this Order and Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

Section 5. Periodic verification.

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix III to this Annex.

The periodic verification period shall be two years.

Section 6. Tests and maximum permissible errors in verification after repair or modification and periodic verification.

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix III to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

APPENDIX I

## Specific essential requirements for people counting systems

1. Definitions.

1.1 Detection sensor. Device that is part of a measuring system and that detects the passage of people through a door or access zone, emitting a signal that activates a meter.

Depending on its position and detection mode, detection sensors can be classified into two distinct groups as described below.

1.1.1 Non-intrusive sensors. These are sensors that are normally installed above zones of passage, without having physical contact with people.

They may be of the following types.

(a) Infra-red. These emit an infra-red light beam and create an invisible light barrier. The system counts a person each time they pass through the light beam. They are used in entrances with large dimensions and high capacities such as cinemas, theatres etc. They are generally arranged in multi-sensor bars.

(b) Thermal. These sensors detect the heat emitted by people passing by. They determine two zones or thresholds of measurement to establish the direction of passage.

(c) Video. These sensors use cameras to monitor the volume of transit in both directions. Their position is determined by the light level in the premises.

1.1.2 Electromechanical or intrusive sensors. These sensors are normally installed at the sides of zones of transit, permitting or preventing passage. For safety reasons, they shall be equipped with panic systems or automatic release devices that operate in the event of electricity cuts, fires or other emergencies. They may be of the following types.

(a) Turnstile. Generally equipped with three arms or levers that fold for safety. In the event of an alarm or emergency, they operate by manual and individual rotation.

Their operation, which may be in both directions, is controlled by means of an electromechanical system with mechanisms that:

– block or prevent two people from passing through at the same time;

– ensure full rotation through to the idle position; prevent reverse rotation once the mechanism has advanced 60° from its idle position.

– They are used in zones with a high transit of people, e.g. commercial premises, airports, metros etc.

(b) Gate. These are motorised gates or doors for controlling the passage of people. Upon receiving a signal from the access control system or a push button, the gate is released to enable passage. Following pressure on the panel, the motor starts up and orders rotation of at least 120º to the next position. The system shall be locked in the event of tampering attempts and unlocked in the event of an emergency.

(c) Code readers. These control the passage of people by reading bar codes, QR codes, NFC codes or other types of codes. These devices are often associated with a passage control system either through turnstiles or doors or under human control. In these systems, reading normally takes place by means of universal devices such as mobile phones or PDAs.

1.2 Calculator. Device that receives signals from the sensor and, potentially, from other associated devices. It processes them and saves the results in the memory until they are used. It also includes results totalling.

1.3 Indicating device. This is the part of the system that continuously displays the measurement results.

2. Operating conditions.

2.1 Environmental conditions.

2.1.1 The temperature range shall be from – 25 °C to + 55 °C. The manufacturer may establish another temperature range, which shall be given on the name plate and which shall not be less than – 10 °C to + 55 °C.

2.1.2 The minimum and maximum storage temperatures or when the instrument is out of service shall be – 25 °C and + 70 °C, respectively.

2.1.3 The people counting system shall withstand damp conditions, with or without condensation and corrosion, depending on the operating climatic environment and its intended location.

2.1.4 The applicable mechanical environment class is M2, as set out in Annex II to Royal Decree 244/2016 of 3 June 2016.

2.1.5 The applicable electromagnetic environment class is E2, as set out in Annex II to Royal Decree 244/2016 of 3 June 2016.

2.1.6 Water tightness and protection from foreign particles shall be at least protection class IP 44 for outdoor use and IP 31 for indoor use in accordance with UNE-EN 60529 “Degrees of protection provided by enclosures (IP Code)”.

2.1.7 Devices consisting of a collection system and a computer program. The computer system may not be subjected to climatic, mechanical or electromagnetic environments if it is not weatherproof and the manufacturer justifies that it is not influenced by such environments. The software may be hosted on a computer or server or in a cloud. This shall be specified on the instrument name plate.

2.1.8 Devices comprising software and universal detection devices. The detection devices may not be subjected to climatic, mechanical or electromagnetic environments if the manufacturer justifies that it is not influenced by such environments. This shall be specified on the instrument name plate.

3. Maximum permissible errors. The instrument indications shall be such that its error shall not exceed the values set out below.

3.1 At the conformity assessment and commissioning phase.

– Simulation of counting by injection of appropriate signals: ± 0.1 %.

– Operation under type or design examination, Modules B and H: ± 3 %.

– Commissioning, Modules F, D and H. Human test: ± 5 %.

3.2 In the in-service instrument phase.

– Human test: ± 6 %.

4. Permitted influences on mechanical and electromagnetic disturbances.

4.1 The variation of a measurement result under the influence of mechanical and electromagnetic disturbances shall not exceed the critical variation value set out in point 4.2, or it shall be clearly indicated that the measurement indication is invalid or that the instrument shall cease to function.

4.2 The critical variation value is equal to 3 %.

5. Suitability.

5.1 A two-way communication protocol between the detection sensor and the meter shall be in place to ensure the fidelity and functioning of that communication and, in the event of a fault, the people counting system shall leave the system out of service, causing an alarm in the form of an acoustic and/or light signal.

5.2 A people counting system shall store the values logged, where this is permitted by data protection law, for at least one year, if it is switched off from its power supply, unless its data have been securely downloaded.

5.3 Installation.

5.3.1 Detection systems shall ensure that all zones of passage are fully covered and avoid false counts.

5.3.2 They shall be fitted with luminous indicators that shall initially be used to adjust the system and which shall be used as warning indicators to alert the user to any problem with the counting or communication with other recording or monitoring devices.

5.3.3 These instruments may have supplementary or control devices to ensure the correct positioning or layout of their detection sensors to ensure compliance with maximum permissible errors.

## APPENDIX II

## **Technical test procedure for conformity assessment of people counting systems**

Conformity assessment of people counting systems with regard to the requirements applicable to them shall be carried out in accordance with the requirements established in Section 4 of this Annex.

1. Modules B and H1. The tests to be carried out shall be carried out on the complete equipment and to this end the applicant shall provide all component parts of the instrument. The equipment shall be accompanied by a technical report describing the operation of the people counting system and a simulation set appropriate to each type of meter for the performance of the counting simulation tests.

1.1 Laboratory testing. The manufacturer shall specify the rated operating conditions applicable to the instrument.

In particular, the climatic environment class, which corresponds to the minimum range – 10 °C to 55 °C; the mechanical environment class, in which the instrument is intended to be used, and the power supply limits for which the instrument is designed. The manufacturer shall specify and justify the parts of the counting system affected by those environments.

1.1.1 Operational tests

– General operation: check of the different devices that make up the system.

– Alarm: check of the people counting system alarm in the event of malfunctions such as loss of communication between devices or variations in the supply voltage below the prescribed limits.

1.1.2 Counting simulation test based on injection of appropriate signals. This test consists of testing the measurement chain of the people counting system by comparing the counts obtained when injecting simulated signals representing the detection sensor with the indications given by the instrument being tested.

1.1.3 Influence factor and disturbance tests.

These tests may not be applicable in accordance with points 2.1.7 and 2.1.8 of this Annex.

The test procedures applicable to the programmes described below shall be in accordance with the versions in force of the internationally approved normative documents or harmonised standards.

1.1.3.1 Programme 1. Climatic environment tests.

– Dry heat.

Table 1. Applicable regulations for the dry heat test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-2. “Environmental tests. Part 2-2: Tests. Test B: Dry heat” and UNE-EN 60068-3-1. “Environmental tests. Part 3-1: Supporting documentation and guidance. Cold and dry heat tests. |
| Purpose | The test consists of exposing the people counting system in operating conditions to a temperature of + 55 °C for two hours. |

In the event the manufacturer chooses another temperature range as set out in point 2.1.1 of Appendix I to this Annex, the metrological control body shall adapt the temperature at which the dry heat test is to be performed according to the temperature declared by the manufacturer.

After this environmental test, the people counting system shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex.

– Cold.

Table 2. Applicable regulations for the cold test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-1. “Environmental tests. Part 2-1. Tests. Test A: Cold” and UNE-EN 60068-3-1. |
| Purpose | The test consists of exposing the people counting system in operating conditions to a temperature of – 25 °C for two hours. |

In the event the manufacturer chooses another temperature range as set out in point 2.1.1 of Appendix I to this Annex, the metrological control body shall adapt the

temperature at which the cold test is to be performed according to the temperature declared by the manufacturer.

After this environmental test, the people counting system shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex.

– Damp heat.

Table 3. Applicable regulations for damp heat test

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-30. “Environmental tests. Part 2.30: Tests. Test Db: Damp heat, cyclic (12 h + 12 h cycle)” and UNE-EN 60068-3-4. “Environmental tests. Part 3-4: Supporting documentation and guidance. Damp heat testing”. |
| Purpose | This test consists of exposing the people counting system in operating conditions to cyclical temperature variations between 25 °C and 55 °C, while keeping the relative humidity between 93 % and 95 %.<br>Two cycles of this test shall be performed. |

After this environmental test, the people counting system shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex.

1.1.3.2 Programme 2. Tests in mechanical environment.

(Not applicable to people-counting systems in fixed installations)

– Random vibrations.

Table 4. Applicable regulations for random vibration testing

| | |
|---|---|
| Applicable standard | UNE-EN 60068-2-64. “Environmental tests. Part 2-64: Tests. Test Fh: Vibration, broadband random and guidance”. |
| Purpose | This test consists of making the people counting system vibrate in operating conditions, sweeping the frequency in the range 10 Hz–150 Hz at root mean square (RMS) acceleration level of 1.6 $m.s^{-2}$ with a with an acceleration spectral density (ASD) of:<br>0.05 $m^2s^{-3}$ for 10 Hz–20 Hz.<br>3 dB/octave for 20 Hz-150 Hz. |

| | |
|---|---|
| | Vibrations shall thereafter be applied along three main perpendicular axes, with a minimum duration of two minutes per axis. |

After this test, the people counting system shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex.

– Mechanical shock.

Table 5. Applicable regulations for the mechanical shock test

| | |
|---|---|
| Applicable standard | 60068-2-31. “Environmental tests. Tests. Test Ec: Rough handling shocks, primarily in equipment-type specimens”. |
| Purpose | This test consists of allowing the people counting system to fall freely under operating conditions, on one of its edges on the test surface from a height of 25 mm. |

After this test, no critical fault shall occur.

1.1.3.3 Programme 3. Electromagnetic disturbance tests.

– Variations in power supply.

Table 6. Applicable regulations for power supply variation testing

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-1. “Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 1: Overview of IEC 61000-4 series”. |
| Purpose | This consists of exposing the people counting system in operating conditions to a change in supply voltage that falls within the voltage range indicated by the manufacturer and that shall include voltages that range from 15 % less and 10 % more than the intended nominal electrical voltage. There shall be no indication when the power supply of the people counter varies outside the established limits, and it may exceed the maximum permissible errors. |

After this test, the people counting system shall function correctly and respect the maximum permissible errors set out in point 3.1 of Appendix I to this Annex.

– Electrostatic discharges.

Table 7. Applicable regulations for the electrostatic discharge test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-2. “Electromagnetic compatibility (EMC). Part 4-2: Testing and measurement techniques. Electrostatic discharge immunity test”. |
| Purpose | The test consists of exposing the people counting system in operating conditions to electrostatic contact discharges of 6 kV and airborne discharges of 8 kV. |

After this test, no critical fault shall occur.

– Electrical bursts.

Table 8. Applicable regulations for the electrical bursts test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-4. “Electromagnetic compatibility (EMC). Part 4-4: Testing and measurement techniques. Electrical fast transient/burst immunity test”. |
| Purpose | This test consists of exposing the people counting system in operating conditions to transient voltage bursts in the form of a double-exponential wave. Each impulse shall have a rise time of five nanoseconds and a duration at half amplitude of 50 nanoseconds. The duration of the burst shall be 15 milliseconds, with a periodicity of 300 milliseconds. The impulse peak amplitude shall be 1 000 V. This shall be applied for the time necessary to simulate five measurement speeds, with errors within the permitted margins. |

After this test, no critical fault shall occur.

– Radiated electromagnetic immunity.

Table 9. Applicable regulations for the radiated electromagnetic immunity test

| | |
|---|---|
| Applicable standard | UNE-EN 61000-4-3. “Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test”. |

| | |
|---|---|
| Purpose | This test consists of exposing the people counting system in operating conditions to electromagnetic fields radiated in the frequency range 80 MHz to 2 000 MHz, with an electric field intensity level of 3 V/m, and an 80 % amplitude modulation, sine wave of 1 kHz. |

After this test, no critical fault shall occur.

1.2 Tests after installation. The report submitted for type or design examination shall explain the details for the positioning and settings of the people counting system, for all possible types of facilities.

The people counting system shall be installed and used in accordance with the instructions given in that report.

At least 500 measurements shall be taken under conditions with a real flow of people, under different temperature and humidity conditions, and if possible on different days; the maximum permissible errors set out in point 3.1 of Appendix I to this Annex shall not be exceeded.

The results obtained by the people counting system can be verified using a system of video cameras positioned in such a way as to clearly record the flow of people in the premises subject to measurement. The recording shall ensure anonymity, avoiding any personal identification.

This test may be carried out in a laboratory or representative installation if it is established that the installation has no influence on the metrological specifications of the people counting system.

2. Modules F and D. The tests to be carried out for these Modules shall consist of checking the conformity of the instrument with the approved model and the laboratory and post-installation tests mentioned above as described below.

2.1 Laboratory tests.

2.1.1 Operational tests These tests shall be carried out in accordance with point 1.1.1 of this Appendix.

2.1.2 Counting simulation test based on injection of appropriate signals. This test shall be carried out in accordance with point 1.1.2 of this Appendix.

2.2 Tests after installation. The correct installation and adjustment of the instrument shall be checked and at least 100 measurements shall be completed under conditions of real inflow of people; the maximum permissible errors set out in point 3.1 of Appendix I to this Annex shall not be exceeded.

This test may be carried out in a laboratory or representative installation if, in the type examination assessment process, it has been determined that the installation has no influence on the metrological specifications of the people counting system.

If there is no influence from the installation, testing for position changes shall not be necessary.

## APPENDIX III

### Technical test procedure for verification after repair or modification and for periodic verification of people counting systems

The procedure for verification after repair or modification and for periodic verification for a people counting systems shall consist of the procedures and actions set out below.

1. Administrative examination. For verification after repair or modification, administrative examination shall be carried out in accordance with Article 9 of this Order.

For periodic verification, it shall be carried out in accordance with Article 15 of this Order.

2. Metrological examination. The people counting systems shall continue to satisfy the essential requirements that led to them being brought to market and put into service.

The tests listed below shall be carried out to demonstrate compliance.

2.1 In the verification after repair or modification: at least 100 measurements shall be taken under conditions with a real flow of people and the maximum permissible errors set out in point 3.2 of Appendix I to this Annex shall not be exceeded.

2.2 In the periodic verification: at least 50 measurements shall be taken under conditions with a real flow of people and the maximum permissible errors set out in point 3.2 of Appendix I to this Annex shall not be exceeded.

2.3 General requirements for conducting tests. All tests shall be carried out under the rated operating conditions described in the mandatory information and established by the manufacturer in the technical documentation associated with the conformity assessment procedure applied for bringing to market and putting into service.

The results obtained by the people counting system can be verified using a system of video cameras positioned in such a way as to clearly record the inflow of people in the premises subject to measurement. The recording shall ensure anonymity, avoiding any personal identification.

The verification tests may be carried out in a laboratory or representative installation if, in the assessment process, it has been determined that the installation has no influence on the metrological specifications of the people counting system.

The maximum permissible errors are those set out in point 3.2 of Appendix I to this Annex.'

Nineteen. Annex XX is added and it shall read as follows:

'**ANNEX XX**

**Charging stations for electric vehicles**

Section 1. *Purpose.*

The purpose of this Annex is to regulate State metrological control of charging stations for electric vehicles, hereinafter referred to as charging stations, intended for the commercial transaction of electrical energy intended for electric vehicles.

Section 2. Specifications of the service.

The supply can be AC or DC and at different charging powers.

The provision of the service is regulated by Royal Decree 184/2022 of 8 March 2022 regulating the activity of providing energy charging services for electric vehicles.

The service may also include two-way energy transactions.

For the measurement of the energy transferred, the charging station may have either a conformity assessed electrical energy meter or a measuring system integrated into the charging station. The metrological requirements set out in this Annex may be different for each of these cases, as well as for the supply of energy in direct or alternating current.

Section 3. *Phases of State metrological control.*

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 4. *Conformity assessment phase.*

The applicable conformity assessment phase for bringing to market and putting into service charging stations is set out in Chapter II of this Order.

Charging stations shall meet the common essential requirements of the applicable measuring instruments in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I of this Annex, and compliance shall be established through the technical testing procedure set out in Appendix II to this Annex.

The modules to be used for the conformity assessment of the charging stations shall be chosen by the manufacturer from among the following options:

(a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;

(b) Module B, type examination, plus Module F, type conformity based on instrument verification;

(c) Module G, conformity based on unit verification.

In addition, the application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of partial or complete conformity to the essential requirements.

Section 5. *Verification after repair or modification.*

Verification after repair or modification of charging stations in an intervention affecting a part of the equipment which is metrologically relevant shall be carried out in accordance with Chapter III of this Order and the provisions of Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

Section 6. *Periodic verification*

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix III to this Annex.

The verification period shall be eight years.

Section 7. *Tests and maximum permissible errors in verification after repair or modification and periodic verification.*

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix III to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

Section 8. *Instruments in service at the entry into force of this Order.*

Charging stations in service on the date of entry into force of this Order shall have four years from its entry into force to be regularised in accordance with the provisions of Appendix IV to this Annex.

Section 9. *Instruments to be installed for two years from the entry into force of this Order.*

The installation of charging stations without conformity assessment is allowed for two years after the entry into force of this Order.

Charging stations installed without conformity assessment shall be adapted in accordance with Appendix IV to this Annex within four years of the entry into force of this Order.

## APPENDIX I

## **Specific essential metrological and technical requirements.**

1. Definitions.

In addition to the definitions included in this section, the definitions in Article 3 of Royal Decree 184/2022 of 8 March 2022 regulating the activity of providing energy charging services for electric vehicles and the symbols set out in Appendix I to Annex X to Royal Decree 244/2016 of 3 June 2016 implementing Law 32/2014 of 22 December 2014 on Metrology apply.

*Charging station*. a device intended to transfer electrical energy to or from an electric vehicle and to measure that energy, storing transaction data and informing the customer and, if necessary, transmitting the information to a billing system.

*Direct current (DC) charging station.* Charging station that supplies DC power to the vehicle regardless of its power supply at the inlet.

*Alternating current (AC) charging station.* Charging station that supplies AC power to the vehicle regardless of its power supply at the inlet.

*Measuring element*. Part of the charging station that transforms an electric voltage and current into a signal proportional to the power and/or energy. This element may include sensors and signal processors (analogue or digital).

*Connection point*. Point where the vehicle is connected to the charging station. If the connection cable is part of the charging station, the connection point is the end of the cable.

*Base maximum permissible error (BMPE)*. Extreme indication error values of a charging station, allowed in this Annex, when the current is varied (for AC and DC charging stations) and voltage (for DC charging stations) within the operating ranges of the charging station, with the charging station in the reference conditions.

*Critical fault*. Fault in the device when subjected to a disturbance where the device appears to operate correctly, but the legally relevant data are incorrect or the shift in the accuracy of the measurement exceeds the requirements. Ceasing to function is not a critical fault. If a disturbance interrupts a transaction then: (a) the transaction shall be cancelled or (b) when the disturbance is removed, the transaction shall be correctly completed.

*MAT*: minimum amount transferred that can be measurable.

2. Description of the specific metrological, technical and design requirements for charging stations.

### 2.1 Units

The measured electrical energy shall be expressed using one of the following symbols: Wh, kWh, MWh or GWh.

## 2.2 Operating conditions

The operating conditions are set out in Table 1.

Table 1 Rated operating conditions

<table>
<tr><td>Condition or quantity of influence</td><td>Values, ranges</td></tr>
<tr><td>Frequency (1)</td><td>$f_{nom} - 2\ \% \le f \le f_{nom} + 2\ \%$ where $f_{nom}$ shall be specified by the manufacturer.<br>If the manufacturer specifies more than one nominal frequency, the operating conditions shall be the combination of all ranges.</td></tr>
<tr><td>Voltage</td><td>AC charging station: for each $U_{nom}$, 0.9 × $U_{nom}$ to 1.1 × $U_{nom}$<br>DC charging station: from the lowest output voltage to the highest output voltage.</td></tr>
<tr><td>Current</td><td>$I_{st}$ minimum value of $I$ for which the system registers energy, declared by the manufacturer<br>$I_{min}$ defined by the manufacturer<br>$I_{min}$ shall be less than or equal to $I_{tr}$ (value of $I$ above which the margin of error lies within the smallest maximum permissible error for the charging station)<br>$I_{max}$ defined by the manufacturer
<table>
<tr><td>Mode</td><td>AC</td><td>AC</td><td>DC</td><td>DC</td></tr>
<tr><td>$I_{tr}$</td><td>≤ 5.0 A</td><td>≤ 0.10 $I_{max}$</td><td>≤ 25 A</td><td>≤ 0.10 $I_{max}$</td></tr>
<tr><td>$I_{max}$</td><td>≤ 80 A</td><td>> 80 A</td><td>≤ 500 A</td><td>> 500 A</td></tr>
</table></td></tr>
<tr><td>Power factor (1)</td><td>≥ 0.9</td></tr>
<tr><td>Temperature</td><td>From the lower temperature limit to the upper temperature limit specified by the manufacturer.<br>The lower temperature limit shall be specified by the manufacturer from the values:<br>– 55 °C, – 40 °C, – 25 °C, – 10 °C, + 5 °C.<br>The upper temperature limit shall be specified by the manufacturer from the values:<br>+ 30 °C, + 40 °C, + 55 °C, + 70 °C, + 85 °C.<br>The lower and upper limits may be specified as intermediate values to these points.</td></tr>
<tr><td>Humidity and water</td><td>With regard to humidity, the manufacturer shall specify the environmental class for which the charging station is intended.<br>H1: enclosed places where charging station is not exposed to condensed water, precipitation or ice formations.<br>H2: enclosed places where the charging station may be exposed to condensed water, water from sources other than rain and ice formations.<br>H3: open places with average climatic conditions.</td></tr>
<tr><td>Harmonics (1)</td><td>AC charging station: shall function correctly when the supply voltage distortion is less than 10 % and the load current distortion is less than 3 % for all harmonics indices.</td></tr>
<tr><td>Ripple (2)</td><td>DC charging station: The ripple produced at the output of the charging station shall comply with standard IEC 61851-23.<br>The station shall only measure energy having frequencies up to 2 kHz.</td></tr>
<tr><td>Load balance (1)</td><td>Polyphase charging stations shall operate correctly with any combination of phases enabled.</td></tr>
<tr><td>MMQ (3)</td><td>AC charging station: shall not be greater than 0.1 kWh<br>DC charging station: shall not be greater than 1.0 kWh</td></tr>
<tr><td colspan="2">(1) Applies only to AC stations<br>(2) Applies only to DC stations<br>(3) If there is no MMQ marking, the maximum value is assumed.</td></tr>
</table>

## 2.3 Accuracy class

The manufacturer shall state the accuracy class of the charging station as Class A, B or C.

The charging station shall be designed and manufactured in such a way that the error does not exceed the maximum permissible error for the specified class under rated operating conditions.

The charging station shall be designed and manufactured in such a way that no critical fault occurs when it is exposed to the disturbances set out in point 2.8.

2.4 Transfer of bi-directional energy.

Where a charging station is capable of bi-directional energy transfer from the charging station to the electric vehicle and from the electric vehicle to the charging station, it shall meet the requirements set out in this Annex in both directions and shall have a register for each direction.

The customer interface shall be able to display all necessary information related to the transfers in both directions.

The station shall have at least one of the configurations described below.

Two registers for bi-directional stations: for stations specified to measure negative and positive flow, the results shall be stored in different registers.

A single register for stations with positive energy flow: for stations that can measure and record energy in positive flow. The station shall be designed so that it measures energy only in the positive flow or, in the event that its design enables it to measure in both directions, it shall have a device specified by the manufacturer to prevent reverse flow.

2.5 Base maximum permissible errors in the energy transferred.

The intrinsic error shall be within the base maximum permissible errors set out in Table 2 for the specified current ranges when the energy is at least MAT and under reference conditions.

Table 2 Accuracy classes

| Quantity | | Percentage error limits for class index | | |
|---|---|---|---|---|
| Current *I* | Power factor | A (2 %) | B (1 %) | C (0.5 %) |
| $I_{st} \le I < I_{min}$ | > 0.9 | ± 25 | ± 15 | ± 10 |
| $I_{min} \le I < I_{tr}$ | > 0.9 | ± 2.5 | ± 1.5 | ± 1.0 |
| $I_{tr} \le I \le I_{max}$ | > 0.9 | ± 2.0 | ± 1.0 | ± 0.5 |

2.6 Combined error.

When the operating range of the charging station covers more than one temperature range, then the requirements for each temperature range apply.

The composite error at a certain charge shall be calculated according to the following formula.

$$e_c = \sqrt{e^2(I, \cos\varphi) + \delta^2(T, I, \cos\varphi) + \delta^2(U, I, \cos\varphi) + \delta^2(f, I, \cos\varphi)}$$

Where:

$e(I,\cos\phi)$ = the intrinsic error with a given charge;

$\delta$ $(T,I,\cos\phi)$ = the additional error as a percentage due to temperature variation at the same charge;

$\delta$ $(U,I,\cos\phi)$ = the additional error as a percentage due to voltage variation at the same charge;

$\delta$ $(\phi,I,\chi o\sigma\phi))$ = the additional error as a percentage due to frequency variation at the same charge.

The highest values for the additional errors as a percentage due to variation in the respective influence quantities within their specified operating ranges shall be taken.

Table 3. Maximum permissible composite error values for AC charging stations (MPE)

| Current | Power factor | Operating temperature range | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 °C to 30 °C | | | – 10 °C to 5 °C or 30 °C to 40 °C | | | – 25 °C to – 10 °C or 40 °C to 55 °C | | | – 40 °C to – 25 °C or 55 °C to 70 °C | | |
| | | Class index | | | | | | | | | | | |
| | | A | B | C | A | B | C | A | B | C | A | B | C |
| Single-phase charging station; polyphase charging station with load balance | | | | | | | | | | | | | |
| $I_{min} \le I \le I_{tr}$ | 1 | ± 3.5 | ± 2.0 | ± 1.0 | ± 5.0 | ± 2.5 | ± 1.3 | ± 7.0 | ± 3.5 | ± 1.7 | ± 9.0 | ± 4.0 | ± 2.0 |
| $I_{tr} \le I \le I_{max}$ | 0.5 inductive | ± 3.5 | ± 2.0 | ± 0.7 | ± 4.5 | ± 2.5 | ± 1.0 | ± 7.0 | ± 3.5 | ± 1.3 | ± 9.0 | ± 4.0 | ± 1.5 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1<br>0.8 capacitive | | | | | | | | | | | | |
| Polyphase charging stations under one single-phase charge but with balanced polyphase voltages in their voltage circuits | | | | | | | | | | | | | |
| $I_{tr} \leq I \leq I_{max}$ | 0.5 inductive<br>1<br>0.8 capacitive | ± 4.0 | ± 2.5 | ± 1.0 | ± 5.0 | ± 3.0 | ± 1.3 | ± 7.0 | ± 4.0 | ± 1.7 | ± 9.0 | ± 4.5 | ± 2.0 |

Table 4. Maximum permissible composite error values for DC charging stations (MPE)

| Current value | Operating temperature range | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 °C to 30 °C | | – 10 °C to 5 °C or<br>30 °C to 40 °C | | – 25 °C to – 10 °C or<br>40 °C to 55 °C | | – 40 °C to – 25 °C or<br>55 °C to 70 °C | |
| | Class index | | | | | | | |
| | 1 | 0.5 | 1 | 0.5 | 1 | 0.5 | 1 | 0.5 |
| 0.25 Imax ≤ I ≤ Imax | ± 2.0 | ± 0.7 | ± 2.5 | ± 1.0 | ± 3.5 | ± 1.3 | ± 4.0 | ± 1.5 |

## 2.7 Permissible effects of influence quantities

The temperature coefficient of the charging station shall comply with the requirements set out in Table 5 below when the charging station operates under reference conditions.

Table 5. Temperature coefficient

| Influence quantity | Temperature coefficient limits as a percentage (% / K) for class index | | |
|---|---|---|---|
| | A (2 %) | B (1 %) | C (0.5 %) |
| Temperature coefficient (c) within a temperature range that is not less than 15 K and not more than 23 K, for a current $I_{tr} \leq I \leq I_{max}$ | ± 0.1 | ± 0.05 | ± 0.03 |
| The verification of requirements may be limited to only the extremes of the range if the charging station contains a meter with a conformity assessment whose type assessment specifications comply with those set out in this Annex. | | | |

If the load current remains constant at a point within the nominal operating range, with the charging station operating under reference conditions, and where a single influence quantity varies from its value under reference conditions to its extreme values as defined in Table 6 below, the error variation shall be such that the additional

percentage error shall not exceed the limits specified in that table. The charging station shall continue to operate after the completion of each of these tests.

Table 6. Maximum permissible additional error due to influence quantities

| Influence quantity | Value | Maximum permissible additional error (%) for charging stations of class | | | |
|---|---|---|---|---|---|
| | | Current | A (2 %) | B (1 %) | C (0.5 %) |
| Self-heating | Maintaining current at $I_{max}$ | $I_{max}$ | ± 1 | ± 0.5 | ± 0.25 |
| Variation of AC voltage<br>AC charging station †| 0.9 $U_{nom\_min}$ < $U$ < 1.1 $U_{nom\_max}$ | $I_{tr} \leq I \leq I_{max}$ | ± 1.0 | ± 0.7 | ± 0.2 |
| Variation in mains frequency<br>AC charging station<br>† | Each $f_{nom}$ ± 2 % | $I_{tr} \leq I \leq I_{max}$ | ± 0.8 | ± 0.5 | ± 0.2 |
| Harmonics in current and voltage circuits(1)<br>AC charging station | d < 5 % I<br>d < 10 % U | $I_{tr} \leq I \leq I_{max}$ | ± 1.0 | ± 0.6 | ± 0.3 |
| Reversed phase order for three-phase charging stations.<br>†<br>‡ | Any two phases interchanged | $I_{tr} \leq I \leq I_{max}$ | ± 1.5 | ± 1.5 | ± 0.1 |
| Conducted disturbances, low frequency(5)<br>‡ | 2 kHz – 150 kHz | $I_{tr} \leq I \leq I_{max}$ | ± 3.0 | ± 2.0 | ± 2.0 |
| Continuous magnetic induction of external origin(2) | 200 mT<br>at 30 mm from the core surface(2) | $I_{tr} \leq I \leq I_{max}$ | ± 3 | ± 1.5 | ± 0.75 |
| Magnetic induction of external origin | 400 A/m | $I_{tr} \leq I \leq I_{max}$ | ± 2.5 | ± 1.3 | ± 0.5 |

| Influence quantity | Value | Maximum permissible additional error (%) for charging stations of class | | | |
|---|---|---|---|---|---|
| | | Current | A (2 %) | B (1 %) | C (0.5 %) |
| (AC, power frequency) † | | | | | |
| Radiated RF electromagnetic fields. | $f$ = 80 MHz to 6 000 MHz<br>Field strength ≤ 10 V/m | $I_{tr} \leq I \leq I_{max}$ | ± 3 | ± 2 | ± 1 |
| Conducted disturbances induced by RF fields(3) ‡ | $f$ = 0.15 MHz to 80 MHz<br>Amplitude ≤ 10 V | $I_{tr} \leq I \leq I_{max}$ | ± 3 | ± 2 | ± 1 |
| Operation of ancillary devices(4) | Ancillary devices operating with $I = I_{tr}$ e $I_{max}$ | $I_{tr} \leq I \leq I_{max}$ | ± 0.7 | ± 0.3 | ± 0.15 |

† This requirement does not need to be checked if the charging station contains a meter with a conformity assessment whose type assessment specifications comply with those set out in this Annex.

‡ This requirement is not deemed relevant for DC charging stations because the influence will be filtered out by the regulated process of conversion from AC to DC.

(1) Provided that the RMS value of the current does not exceed $I_{max}$ and the peak current value does not exceed 1.41 $I_{max}$.

(2) Manufacturers may additionally include an alarm when a continuous magnetic induction (DC) of more than 200 mT is detected.

(3) Direct or indirect conducted disturbances induced by radio-frequency fields.

(4) This only applies to ancillary devices that could be used (but that are not necessary) during a charging session.

(5) For the charging station in DC, the conducted interference in this frequency range is usually generated by the power supply of the charging station.

## 2.8 Permissible effect of disturbances

The charging station shall withstand the disturbances that may arise under normal conditions of use; no critical fault shall occur due to any of the disturbances listed in Table 7, Table 8 and Table 9.

If the charging station is used under the conditions described in Table 7, Table 8 or Table 9 and there is no transaction in progress, a change in the registers or pulses of the test outlet shall not be deemed a critical fault.

2.8.1 Electrical disturbances

Electrical disturbances are defined in Table 7. Electrical disturbances shall not result in an error shift greater than 1.0 BMPE.

Table 7. Electrical disturbances

| Disturbance | Level | Permissible effects |
|---|---|---|
| Electrostatic discharges | 6 kV contact discharge<br>8 kV air discharge | No critical fault. No damage shall occur. |
| Fast transients ‡ | Test voltage:<br>– in voltage and current circuits: 2 kV<br>– in auxiliary circuits: 1.0 kV. | No critical fault. No damage shall occur. |
| Voltage dips. ‡ | Test (a) 30 %, 0.5 cycles<br>Test (b) 60 %, 1 cycle<br>Test (c) 60 %, 25 cycles | No critical fault. |
| Voltage interruptions ‡ | 0 %, 250 cycles | No critical fault. |
| Immunity to surges (AC power supply) †‡ | Voltage circuits: 2 kV phase to phase, 4 kV phase to earth<br>Auxiliary circuits: 1 kV phase to phase, 2 kV phase to earth | No critical fault. No damage shall occur. |
| Short-duration overcurrents †‡ | 5 $I_{max}$, with a limit value of 3 kA. | No critical fault. No damage shall occur. |
| Impulse voltage ‡ | 1.5 kV $U$ (100 V ≤ $U$ < 150 V)<br>2.5 kV $U$ (150 V ≤ $U$ < 300 V)<br>4.0 kV $U$ (300 V ≤ $U$ < 600 V)<br>4.0 kV $U$ (600 V ≤ $U$) | No critical fault. No damage shall occur. |

† This requirement does not need to be checked if the charging station contains a meter with a conformity assessment whose type assessment specifications comply with those set out in this Annex.

‡ This requirement shall not be deemed relevant for DC charging stations because the influence

| |
|---|
| will be filtered by the regulated process of conversion from AC to DC. |

### 2.8.2 Environmental disturbances

Environmental disturbances are defined in Table 8. Environmental disturbances shall not result in an error shift exceeding 1.0 MPBE.

Table 8. Environmental disturbances

| Disturbance | Level | Permissible effects |
|---|---|---|
| Protection against solar radiation | 0.76 $W \cdot m^2 \cdot nm^{-1}$ at 340 nm, repeating in cycles for 66 days. | No alteration to appearance or deterioration in functionality, metrological properties or sealing. |
| Dust penetration protection | IP 5X, category 2 enclosure | No interference with correct operation or impairment of safety, including tracking over creepage distances. |
| Dry heat | One standard temperature above the upper specified temperature limit, 2 hours | No critical fault. |
| Cold | One standard temperature below the lower specified temperature limit, 2 hours | No critical fault. |
| Damp heat | H1: 30 °C, 85 %;<br>H2: Cycles between 25 °C, 95 % and 40 °C, 93 %;<br>H3: Cycles between 25 °C, 95 % and 55 °C, 93 %. | No critical fault. No evidence of any mechanical damage or corrosion |
| Water | H3 only, 0.07 L/min (per nozzle), 0° and 180°, 10 min | No critical fault. No evidence of any mechanical damage or corrosion |
| Note: for a complex DC charging station, these tests shall be applied only to the console. | | |

### 2.8.3 Mechanical disturbances

Mechanical disturbances are intended to simulate the conditions found during transportation. Where a charging station is too large to reasonably perform the

associated test at a reasonable cost, the corresponding requirement may be removed. These requirements may also be removed from type approval if on-site tests are carried out before a charging station is put into service. After the disturbances, the charging station shall comply with the base maximum permissible errors in the energy transferred set out in point 2.5 of this Appendix.

Table 9. Mechanical disturbances

| Disturbance | Level | Permissible effects |
|---|---|---|
| Vibration | Vibration in the 3 axes, perpendicular to each other. | No critical fault. The operation of the charging station shall not be affected after the disturbance |
| Shock | Pulse shape: semi-sinusoidal. Peak acceleration: 30 $g_n$,<br>Duration of the impulse: 18 ms | No critical fault. The operation of the charging station shall not be affected after the disturbance |
| Note: These tests shall be applied to a unitary charging station and to the console of a complex DC charging station. | | |

2.9 Durability

The charging station shall be designed to maintain adequate stability of its metrological characteristics between its periodic verifications, provided that it is correctly installed, maintained and used in accordance with the manufacturer's instructions in the environmental conditions for which it is intended.

3. Aptitude

The invoiced energy shall correspond to the energy supplied and measured at the connection point to the electric vehicle.

Where the charging station is able to service several vehicles simultaneously, each transaction shall be measured, presented and accounted for individually. The charging power shall be that available for each vehicle.

A charging station that applies corrections to compensate for the energy loss introduced by the cable and connector between the position where the energy is measured and the connection point shall comply with the conditions listed below.

(a) It shall ensure that the cable and connector are not replaceable and that they are secured by an appropriate seal; or

(b) if they can be replaced while the charging station is sealed, the replacement parts shall comply with the conditions listed below.

(i) They shall be identical in all respects to the parts originally verified.

(ii) They shall be identified as replaceable on the type approval certificate.

(ii) They shall include at least the following clearly visible markings located on the elements themselves or the assembly, if they can be combined:

- approval number/identifier;
- manufacturer's name or trademark;
- Manufacturer model;
- any other relevant mark as necessary to distinguish it from similar devices that do not have a conformity assessment.

(iv) The markings mentioned above shall also be documented in the type examination certificate.

The charging station shall be designed in such a way that no leakage of measured energy occurs during the connection.

If a piece of electric vehicle supply equipment (hereinafter, EVSE) is capable of receiving electrical energy from the vehicle to be transferred to the rated source then:

(a) the customer interface shall be able to display all necessary information related to the transactions in both directions;

(b) the EVSE shall be of the "two registers, bidirectional" category as defined in point 2.4 of this Appendix;

(c) the accuracy requirements for both directions shall be met; and

(d) all metrological and functional requirements in points 2 and 3 shall also apply to this type of transaction.

### 3.1 Requirement relating to time of use

The charging station shall be able to determine hourly consumption values using configurable billing periods.

### 3.2 Metrological and technical requirements associated with the clock.

Two possible operating modes are stipulated for the clock:

- by synchronisation to the network frequency;
- by quartz oscillator.

The charging station clock, for the purpose of time of use, shall comply with the requirements set out in the following paragraph.

The time measurement shall be traceable to the national time standard. The deviation of the clock from the charging station shall not exceed 60 seconds. If the clock correction exceeds 60 seconds of the standard time, it shall be considered an adjustment. In this event, a clock adjustment event shall be generated.

### 3.3 Time synchronisation

If time synchronisation is used to ensure that the maximum deviation remains within 60 seconds of the limits set out in point 3.2, it shall not alter the legally relevant parameters, data and records that may affect the measurement or affect compliance with the metrological requirements established for the charging station clock.

### 3.4 Records

The charging station shall ensure that the energy recorded is correct under all circumstances. All relevant transaction information shall be available to the user and the data shall be recorded in the memory of the charging station.

The charging station shall store metrologically relevant information from all transactions for at least one year. It shall have a register of events as set out in Article 5 of Annex IV to Royal Decree 244/2016 of 7 June 2016.

## 4. Entries

In addition to those set out in Article 12 of Annex II and those set out in Annex III to Royal Decree 244/2016 of 7 June 2016, this instrument in particular shall have the entries listed below.

- Type.

- Voltage range (minimum and maximum output voltage).
- Current range (start-up, minimum, transitional and maximum).
- Frequencies for AC and/or 0 Hz for DC.
- Temperature range.
- Accuracy class.
- MMQ (minimum measurement quantity).

4 Remote control of the charging station

The charging station operator is allowed remote access to the charging station to perform the following operations:

- transaction readings;
- operational checks;
- price changes;
- software updates;

and any other necessary operations for the proper operation of the charging station provided that no legally relevant parameter is altered and no legally relevant records are deleted.

5. Transaction details.

The user shall be able to access the legally relevant transaction data through the customer interface. These data shall be displayed as detailed below:

- Mandatorily, by means of an indicator visible from outside the charging station and capable of providing all the legally relevant transaction data in characters at least 4 mm high.
- In addition, they may be displayed through a non-local user interface that meets the following requirements:
    - a communication system to send all legally relevant data;
    - all legally relevant data shall be protected by cryptographic systems;
    - the data shall be provided along with all the information necessary to verify their authenticity.

Charging stations shall provide all users with the following information:

- the price per kWh and, where applicable, the applicable hourly rates;
- the available charging powers and their prices, if applicable;
- the tariff for the time of use of the charging station, if applicable.

Economic transaction information for the charging:

- the charging power used;
- the time spent, starting and ending time;
- the amount of energy transferred;
- the total amount, with details of the different applicable concepts such as energy, charging power, time of use etc.

6. Multiple tariffs.

A charging station that can charge multiple prices during a transaction shall comply with the requirements detailed below.

(1) The price charged shall not change during the transaction unless agreed in advance by the user.

(2) It shall be able to measure and store all relevant billing data.

(3) The sum of all the energy registered in multi-tariff registers shall be equal to the total energy transferred during the transaction.

(4) Only one register may be active in any period of time during a transaction.

(5) For ad hoc transactions, the following shall be clear for each part of the transaction:

(a) the amount of energy transferred;

(b) the time interval over which the energy was transferred;

(c) the direction of the energy transfer, if applicable;

(d) the unit price that was applied.

Multiple tariffs shall not be applied unless the consumer has agreed by interacting with the charging station or in a contractual agreement.

APPENDIX II

**Technical test procedure for conformity assessment of charging stations**

Conformity assessment of charging stations with regard to the requirements applicable to them shall be carried out in accordance with the requirements established in Section 4 of this Annex.

Charging stations shall comply with the metrological and technical requirements set out in Appendix I to this Annex and in the applicable standards in force, or those standards that replace them, and in the legislation in force.

The measuring system used as a reference for the comparison of test results shall have an uncertainty of less than 1/3 of the maximum permissible error for the tested charging station.

A) Type examination of charging stations (Module B) and conformity based on unit verification (Module G). The type examination shall be carried out in accordance with Article 5 of Annex I to Royal Decree 244/2016 of 3 June 2016. Unit verification shall be carried out in accordance with Article 15 of Annex I to Royal Decree 244/2016 of 3 June 2016.

The tests shall be carried out on the complete equipment, to which end the applicant shall provide all parts of the charging station together with the necessary supplementary devices. Together with the equipment, the technical documentation provided for in Article 13 of Royal Decree 244/2016 of 3 June 2016 shall be provided. The manufacturer shall specify the operating conditions applicable to the charging station. In particular:

a) whether it is located inside or outside;
b) charging power(s);
c) charging mode as defined in ITC BT 52 “Special Purpose Facilities. Infrastructure for charging electric vehicles”;
d) individual or multiple charging capability;
e) the maximum, minimum, start-up and transitional current values;
f) the reference voltage and frequency and output values;
g) the accuracy class and whether it is three-phase or single-phase;
h) the type of connectors or sockets, as set out in ITC BT 52 “Special Purpose Facilities. Infrastructure for charging electric vehicles”;
i) type of enclosure protection;
j) type of insulation;
k) measurement software description;

l) communication system description;

m) nominal reference conditions;

n) for DC charging, the type of control system and whether it will be connected to a public network in AC or DC, in accordance with the classification of UNE-EN 61851-23 ‘Electric vehicle conductive charging system. Part 23: DC electric vehicle supply equipment’, in force.

1. Testing conditions

The tests shall be performed at the reference values given in Table 10, with the exception of the influence quantities to be assessed. The charging conditions during the assessment shall remain within the tolerance limits given in Table 11.

Table 10 Reference conditions for type approval testing

| Quantity | Reference conditions | Tolerances |
|---|---|---|
| AC voltage | Higher value of $U_{nom}$ | ± 1 % |
| DC voltage | 375 V<br>750 V | ± 50 V |
| Ambient temperature | 23 °C(1) | ± 2 ºC |
| Frequency in AC | $f_{nom}$ | ± 0.3 % |
| Waveform ($U$ and $I$) in AC | Sinusoidal | $d \leq 2$ % |
| Magnetic induction of external origin at reference frequency | 0 T | $B \leq 0.05$ mT |
| Electromagnetic RF fields RF 30 kHz to 6 GHz | 0 V/m | < 1 V/m |
| Operating position for position-sensitive instruments | Mounting as indicated by the manufacturer | ± 3.0º |

| | | |
|---|---|---|
| Load balance (three-phase AC charging station)[2] | Equal current in all phases | ± 2 % |

(1) Tests may be performed at other temperatures if the results are corrected to the reference temperature by applying the temperature coefficient set out in the type tests and provided that an appropriate uncertainty analysis is carried out.

(2) The requirement applies both to phase-to-phase and phase--neutral for polyphase charging stations.

Table 11 Load conditions and their test tolerances

| Quantity | Conditions | Tolerance |
|---|---|---|
| Current | Current range of the charging station | Classes A and B: ± 2 %<br>Class C: ± 1 % |
| Power factor<br>(Only for AC) | Power factor range of the charging station | Current to voltage phase difference: ± 2 º |

2. Test programme

The charging station test is performed using the same transactional process that is used in the normal operation of the charging station. This process shall consist of at least the steps set out below:

1) A charging session shall be started between the charging station and a vehicle using the standard energy marketing protocol. For test purposes, the vehicle may be replaced by a simulator, provided that the usual protocols for energy marketing are respected.

2) It shall charge at a specific power level for a specific amount of energy (this shall be higher than the MAT).

3) The transaction shall be finalised using the communication protocol of the charging station.

4) The supplied energy and, for ad hoc transactions, the cost of the transaction provided by the charging station shall be compared with the

reference standard energy measured and the cost calculated on the basis of that energy.

For DC charging stations, the value of the energy supplied during the ramp-up and ramp-down phases to reach the test power level shall be less than 10 % of the total energy supplied in the test.
The tests may be performed with actual charge or simulated charge.

Energy shall be applied to the charging station for a period of 15 minutes before starting the tests.

The order of test points for the initial intrinsic error shall be from the lowest to the highest current and then from the highest to the lowest current at each rated voltage, starting with the lowest and continuing to the highest. For the DC charging station, the test shall be performed from the minimum output voltage value to the maximum. For each test point, the resulting error shall be the average of these measurements. The minimum transferable quantity of energy shall be supplied at each point.

The determination of the initial intrinsic error (under reference conditions) shall always be performed before the influence quantities tests and before the disturbance tests that are related to an error limit shift requirement or to a critical fault condition for the error.

If a charging station is specified for both single-phase and three-phase operation, both configurations shall be tested.

For the purposes of testing DC charging stations, the DC reference meter shall measure energy only up to 2 kHz.

## 3. Carrying out the tests

The tests to be carried out and satisfactorily passed by the instrument are those in Table 12, which refers to various sections of OIML Guide 22.

Table 12 Type and conformity assessment tests based on unit verification

| Tests | Section of OIML Guide 22 |
|---|---|
| Determination of initial intrinsic error | 7.2.1 |
| Starting current check | 7.2.2 |
| Self-heating | 7.3.2 |
| Temperature dependence | 7.3.3 |
| Voltage variation (AC) (1) | 7.3.4 |
| Frequency variation (AC) (1) | 7.3.5 |
| Harmonics in voltage and current (AC) (1) | 7.3.6 |
| Reversed phase sequence (three-phase) (1) | 7.3.7 |
| Continuous magnetic induction of external origin (1) | 7.3.8 |
| Magnetic field (AC, power frequency) of external origin (1) | 7.3.9 |
| Electromagnetic fields (1) | 7.3.10 |
| Operation of ancillary devices (1) | 7.3.11 |
| Electrostatic discharge (1) | 7.4.2 |
| Fast transients (1) | 7.4.3 |
| Voltage interruptions and dips (1) | 7.4.4 |
| Surges on AC mains power lines (1) | 7.4.5 |
| Short-time overcurrent (1) | 7.4.6 |
| Impulse voltage (1) | 7.4.7 |
| Environmental tests (2) | 7.4.8 |
| Durability test | 7.4.9 |
| Mechanical tests | 7.4.10 |

(1) Electrical disturbance tests can be performed individually with an error check after each test or as a group with a single error check after all tests have been performed.

(2) Environmental disturbance tests can be performed individually with an error check after each test or as a group with a single error check after all tests have been performed.

B) Conformity to type based on product verification (Module F).

Module F shall be carried out in accordance with Article 13 of Annex I to Royal Decree 244/2016 of 3 June 2016.

The tests to be carried out and satisfactorily passed by the instrument are those in Table 13, which refers to various sections of OIML Guide 22.

Table 13 Tests for conformity to type based on product verification

| Tests | Section of OIML Guide 22 |
|---|---|
| Starting current check | 9.2.4.1 |
| Determination of current dependence | 9.2.4.2 |

The tests shall be performed at the reference values given in Table 14. The charging conditions during the assessment shall remain within the tolerance limits given in Table 15.

Table 14 Reference conditions for type approval testing

| **Quantity** | **Reference conditions** | **Tolerances** |
|---|---|---|
| AC voltage | $U_{nom}$ | ± 2 % |
| DC voltage | 375 V<br>750 V | ± 50 V |
| Current | 50 % $I_{max}$ | --- |
| Ambient temperature | 23 °C(1) | ± 5 ºC |
| Frequency in AC | $f_{nom}$ | --- |
| Waveform ($U$ and $I$) in AC | Sinusoidal | $d \leq 2$ % |

| | | |
|---|---|---|
| Magnetic induction of external origin at reference frequency | 0 T ≤ *B* ≤ 0.1 mT | --- |
| Electromagnetic RF fields 30 kHz to 6 GHz | < 2 V/m | --- |
| Phase sequence (three-phase) | L1, L2, L3 | --- |
| Load balance (three-phase AC charging station)(2) | Equal current in all phases | ± 5 % and ± 5 ° |

Table 15 Load conditions and their test tolerances

| Quantity | Conditions | Tolerance |
|---|---|---|
| Current | Current range of the charging station | ± 10 % |
| Power factor<br>(Only for AC) | Power factor range of the charging station | Current to voltage phase difference: ± 5 º |

C) Conformity to type based on quality assurance of the production process (Module D).

Module D shall be carried out in accordance with Article 9 of Annex I to Royal Decree 244/2016 of 3 June 2016.

The tests to be carried out and passed satisfactorily by the instrument are the same as for the product verification defined in Table 13, carried out on the reference values set out in Table 14 and under the charging conditions set out in Table 15.

## APPENDIX III

## **Technical test procedure for verification after repair or modification and for periodic verification of charging stations**

The procedure for verification after repair or modification and for periodic verification shall consist of the procedures and actions set out below.

1. General points.

   The procedure for verification after repair or modification and for periodic verification for charging stations shall consist of the procedures and actions set out below.

   When periodic verification of a charging station is carried out, the verification label shall be affixed at each connection point of the charging station.

   Where a single connection point of a charging station has been repaired or modified, and only the seals at that point have been removed, the verification tests after repair or modification may be carried out only on that point. The time limit for periodic verification of the whole assembly, including that of the repaired or modified station, shall not be altered.

   When the verification is carried out only on the repaired or modified connection point, the verification label or the disqualification label, where applicable, shall be affixed at that connection point and not on the charging station. The following periodic verification shall be carried out before the end of eight years after the periodic verification of any connection point of the charging station.

   If a charging station can simultaneously charge more than one vehicle, it shall be verified that there is no interference between them.

2. Administrative examination.

   The administrative examination for verification after repair or modification shall be carried out in accordance with Article 9 of this Order.

   The administrative examination for periodic verification shall be carried out in accordance with Article 15 of this Order.

3. Metrological examination.

It shall be verified that the charging station, together with its associated devices, meets the metrological and technical requirements set out in Appendix I to this Annex.

3.1 Verification tests

The tests to be carried out and passed satisfactorily by the instrument in the verification after repair or modification or in the periodic verification are the same as for the product verification defined in Table 13, carried out on the reference values set out in Table 14 and under the charging conditions set out in Table 15.

4. Necessary resources

The measuring system used as a reference for the comparison of test results shall have an uncertainty of less than 1/3 of the base maximum permissible error for the tested charging station.

## APPENDIX IV

## **Adaptation or modification criteria and first periodic verification of charging stations**

A charging station shall be deemed to be adapted to another charging station that has a type examination in force if it has the same mechanical, electrical and electronic elements as the approved system (same make and model) and the same design and construction.

1. Adaptation procedure.

The adaptation shall be carried out by a repairer registered in the Metrological Control Register who shall have an express authorisation from the type examination holder for whom they wish to adapt the system to be able to

carry out the adaptation. Once the adaptation has been carried out, the authorised repairer shall seal all the points set out in the type examination of the charging station. The repairer shall certify that they have the manufacturer's authorisation to make the modification and that the new system is adapted at all the points on which the authorisation is based, specifying its make and model, as well as the points at which the system shall be sealed. They shall also affix, to a clearly visible part of the charging station, a data plate bearing the following details:

1. System adapted by .....

2. Company registered in the Metrological Control Register under number .....

3. Adapted to the system make ....., model ....., with type examination number .....

This data plate shall contain all the inscriptions and marks laid down in Article 111 and Annex III of Royal Decree 244/2016 of 3 June 2016. Following this adaptation, the charging station shall be subject to a post-modification verification, as set out in Chapter III of this Order.

The time limit for the first periodic verification shall be as set out in point 6 of this Annex from the time of its adaptation.'

Twenty. Annex XXI is added and it shall read as follows:

**'ANNEX XXI**

**Instruments for measuring the number of particles (PN) emitted by vehicles equipped with compression ignition engines**

Section 1. *Purpose.*

The purpose of this Annex is to regulate State metrological control of instruments for measuring particle numbers, hereinafter, PN meters, for periodic technical inspection of vehicles of categories M and N equipped with compression ignition engines and diesel particulate filters: light-duty vehicles registered for the first time on or after 1 January 2013 and heavy-duty vehicles registered for the first time on or after 1 January 2014.

Section 2*. Phases of State metrological control.*

The State metrological control set out in this Annex is governed by Sections 3 and 4 of Chapter III of Royal Decree 244/2016 of 3 June 2016, which refer to the phases of conformity assessment and in-service instruments respectively.

Section 3. *Conformity assessment phase.*

The applicable conformity assessment phase for bringing to market and putting into service PN meters is set out in Chapter II of this Order.

The PN meters covered by this Order shall comply with the common essential requirements for applicable measuring instruments set out in Annex II to Royal Decree 244/2016 of 3 June 2016, in addition to the specific requirements included in Appendix I to this Annex.

The tests to be carried out for the conformity assessment and the maximum permissible errors shall be as set out in Appendix II to this Annex.

The modules to be used to carry out the conformity assessment of PN meters shall be:

a) Module B, type examination, plus Module D, type conformity based on quality assurance of the production process;
b) Module B, type examination, plus Module F, type conformity based on instrument verification;
c) Module H1, conformity based on full quality assurance plus design examination.

In addition, the application of test programmes corresponding to the normative documents, as defined in Article 2 of Royal Decree 244/2016 of 3 June 2016, or to the guidelines of the High Council of Metrology and/or the guides of the Legal Metrology Commission, shall provide presumption of partial or complete conformity to the essential requirements.

The application of Commission Recommendation (EU) 2023/688 of 20 March 2023 on particle number measurement for the periodic technical inspection of vehicles equipped with compression ignition engines shall provide presumption of conformity with the specific essential requirements set out in point 2 of Appendix I to this Annex.

Section 4*. Verification after repair or modification.*

Verification after repair or modification of PN meters shall be carried out in accordance with Chapter III of this Order and Appendix III to this Annex.

These instruments are covered by the provisions of Article 8 of this Order.

Section 5. *Periodic verification.*

Periodic verification shall be carried out in accordance with Chapter IV of this Order and Appendix IV to this Annex.

The time limit for verification shall be one year.

Section 6. *Tests and maximum permissible errors in verification after repair or modification and periodic verification.*

The maximum permissible errors and the tests to be performed shall be those set out in Appendix I and Appendix III to this Annex, respectively.

These instruments shall continue to comply with the requirements that led to them being brought to market and put into service.

APPENDIX I

**Specific essential requirements for PN meters**

1. Definitions

*Counting efficiency*: the ratio of the PN measuring instrument reading and a traceable reference instrument or device reading.

*HEPA filter (high-efficiency particulate air filter)*: a device that removes particles from the air with efficiency higher than 99.95 % (i.e. class H13 or higher according to EN 1822-1:2019).

*Particle detector*: a device or instrument that indicates the presence of particles when a threshold value of PN concentration is exceeded.

*Particles*: solid (thermally stable) particles with size between 23 nm and at least 200 nm emitted by the vehicle and measured in the airborne phase according to the methods specified in this Annex.

- *Monodisperse particles*: particles with a very narrow distribution around one particle size.
- *Polydisperse particles*: particles with many different particle sizes.

*Particle size*: electrical mobility size, i.e. the diameter of a sphere with the same migration velocity in a constant electric field as the particle of interest.

*PN measuring instrument*: instrument for measuring the PN concentration in the exhaust gas of internal combustion engines sampled during the PTI in the exhaust pipe of a vehicle.

*Sample preconditioning device*: device for diluting and/or removing volatile particles.

*Sampling probe*: tube that is introduced into the exhaust pipe of a vehicle to take gas samples.

## 2. Description of essential metrological requirements for PN meters.

### 2.1. Indication of the measurement result

The instrument shall ensure that:
- the PN per volume is expressed as a number of particles per $cm^3$;
- the inscriptions for this unit are assigned unambiguously to the indication; "#/$cm^3$", "$cm^{-3}$", "particles/$cm^3$" and "1/$cm^3$" are allowed.

### 2.2. Measuring range

The instrument shall ensure that:
- the minimum measuring range, that may be subdivided, is from 5 000 1/$cm^3$ (maximum value for lower range) to twice the PN limit value (minimum value for the upper range);
- the exceedance of the range is indicated visibly by the instrument;
- the measuring range is declared by the PN measuring instrument manufacturer and complies with the minimum range defined in this point. It is recommended that the PN measuring instrument display range be wider than the measuring range, ranging from zero up to at least five times the PN limit value.

### 2.3. Response time

The instrument shall ensure that:
- for measuring PN concentration, the PN measuring instrument including the sampling line and sample preconditioning device (if any) indicates 95 % of the final value of a reference PN sample within 15 seconds after changing from HEPA filtered or ambient air.

### 2.4. Warm-up time

It shall be ensured that:
- the PN instrument does not indicate the measured PN concentration during the warm-up time;

- after the warm-up time, the PN instrument meets the metrological requirements indicated in this Appendix.

2.5. Maximum permissible error (MPE)

The maximum permissible error shall be the greater of the relative maximum relative error ($MPE_{rel}$) and the value defined for the absolute error ($MPE_{abs}$).

- Reference operating conditions (see point 2.12 of this Appendix): $MPE_{rel}$ is 25 % of the actual concentration but not lower than $MPE_{abs}$.
- Rated operating conditions (see point 2.12 of this Appendix): $MPE_{rel}$ is 50 % of the actual concentration but not lower than $MPE_{abs}$.
- Disturbances (see point 2.13 of this Appendix): $MPE_{rel}$ is 50 % of the actual concentration but not lower than $MPE_{abs}$.
- The $MPE_{abs}$ shall be less than or equal to 25 000 1/cm$^3$.

2.6. Efficiency requirements

The counting efficiency requirements are listed below:

| Particle size or geometric mean diameter (GMD) [nm] | Counting efficiency [-] |
|---|---|
| 23 ± 5 % | 0.2 to 0.6 |
| 50 ± 5 % | 0.6 to 1.3 |
| 70 ± 5 % or 80 ± 5 % | 0.7 to 1.3 |
| 100 ± 5 % | 0.7 to 1.3 |
| 200 ± 5 % | 0.5 to 3.0 |

2.7. Linearity requirements

Linearity tests shall ensure that the MPE of the PN measuring instrument are the same as the MPE under reference conditions set out in point 2.5 of this Appendix.

2.8. Zero-level

The zero-level is checked using a HEPA filter. Zero-level is the average signal of the PN measuring instrument with a HEPA filter at its inlet over a period of at least 15 seconds after a stabilisation period of at least 15 seconds. The maximum admissible zero-level is 5 000·1/cm$^3$.

2.9. Volatile removal efficiency

The volatile removal efficiency of the PN measuring instrument shall be more than 95 % of tetracontane ($C_{40}H_{82}$) particles with electrical mobility size 30 nm ± 5 % and with concentration of between 10 000 and 30 000·1/cm$^3$.

2.10. Stability with time or drift

Measurements made by the PN measuring instrument under stable environmental conditions when used in accordance with the manufacturer's operating instructions shall comply with the maximum permissible error under reference operating conditions (see point 2.5).

2.11. Repeatability

The repeatability testing shall ensure that for 20 consecutive measurements of the same reference PN sample carried out by the same person with the same instrument within relatively short time intervals, the experimental standard deviation of the 20 results is not greater than one third of the maximum permissible error (reference operating conditions) for the relevant sample. PN

2.12. Influence quantities

- The reference operating conditions are presented below. The maximum permissible error specified for the reference operating conditions applies (see point 2.5 of this Appendix).

| | |
|---|---|
| Ambient temperature | 20 ºC ± 2 ºC |
| Relative humidity | 50 % ± 20 % |
| Atmospheric pressure | Stable ambient (± 10 hPa) |
| Mains voltage | Nominal voltage ± 5 % |
| Mains frequency | Nominal frequency ± 1 % |
| Vibration | None/negligible |
| Voltage of battery | Nominal voltage of the |

- The minimum requirements for rated operating conditions testing are presented below. The maximum permissible error specified for rated operating conditions applies (see point 2.5. of this Appendix).

| | |
|---|---|
| Ambient temperature (IEC 60068-2-1, IEC 60068-2-2 and IEC 60068-3-1) | From + 5 °C (test level index 2 according to OIML D11) (or less if specified by the manufacturer) to + 40 °C (test level index 1 according to OIML D11) (or more if specified by the manufacturer). When the critical internal temperatures of the PN measuring instrument are out of range, the instrument does not indicate the measured value and indicates a warning |
| Relative humidity (IEC 60068-2-78, | Up to 85 %, no condensation (test level |

| | |
|---|---|
| IEC 60068-3-4 and IEC 60068-2-30) | index 1 according to OIML D11) (when used inside) Up to 95 % condensing (when used outside) |
| Atmospheric pressure | 860 hPa to 1 060 hPa |
| Mains voltage (IEC 61000-2-1 and IEC 61000-4-1) | – 15 % to + 10 % of the nominal voltage (test level index 1 according to OIML D11) |
| Mains frequency (IEC 61000-2-1, IEC 61000-2-2 and IEC 61000-4-1) | ± 2 % of the nominal frequency (test level index 1 according to OIML D11) |
| Royal Decree 244/2016 of 3 June 2016, | 12 V battery: 9 V to 16 V; 24 V battery: 16 V to 32 V |
| Internal battery voltage | Low voltage, as specified by the manufacturer, up to the voltage of a new or fully charged battery of the specified type |

## 2.13. Disturbances

Critical faults as specified in the maximum permissible error for disturbances (see point 2.5 of this Appendix) shall either not occur or shall be detected and acted upon by means of checking facilities in case of the following minimum requirements for disturbances described below.

| | |
|---|---|
| Mechanical shock (IEC 60068-2-31) | Hand-held: 1 fall of 1 m on each bottom edge. Transportable: 1 fall of 25 mm on each bottom edge (test level index 1 according to OIML D11) |
| Vibration only for hand-held instruments (IEC 60068-2-47, IEC 60068-2-64 and IEC 60068-3-8) | From 10 Hz to 150 Hz, 1.6 $ms^{-2}$, 0.05 $m^2s^{-3}$, – 3 dB/octave (test level index 1 according to OIML D11) |
| AC mains voltage dips, short interruptions and reductions (IEC 61000-4-11, IEC 61000-6-1 and IEC 61000-6-2) | 0.5 cycles: reduction to 0 %<br>1 cycle: reduction to 0 %<br>25/30 (*) cycles:<br>reduction to 70 %<br>250/300 (*) cycles:<br>reduction to 0 %<br>(*) For 50 Hz/60 Hz respectively<br>(test level index 1 according to OIML D11) |
| Royal Decree 244/2016 of 3 June 2016, | Amplitude 2 kV<br>Repetition rate 5 kHz<br>(test level index 3 according to OIML D11) |
| Burst (transients) on signal, data and control lines (IEC 61000-4-4) | Amplitude 1 kV<br>Repetition rate 5 kHz<br>(test level index 3 according to OIML |

| | |
|---|---|
| | D11) |
| Royal Decree 244/2016 of 3 June 2016, | Line to line 1.0 kV Line to ground 2.0 kV (test level index 3 according to OIML D11) |
| Surges on signal, data and control lines (IEC 61000-4-5) | Line to line 1.0 kV Line to ground 2.0 kV (test level index 3 according to OIML D11) |
| Electrostatic discharge (IEC 61000-4-2) | 6 kV contact discharge 8 kV air discharge (test level index 3 according to OIML D11) |
| Radiated, radio-frequency, electromagnetic fields (IEC 61000-4-3 and IEC 61000-4-20) | 80 (26 *) MHz up to 6 GHz, 10 V/m (test level index 3 according to OIML D11) * For an equipment under test, without any cabling to apply the test, the lower frequency limit is 26 MHz |
| Conducted radio-frequency fields (IEC 61000-4-6) | 0.15 up to 80 MHz, 10 V (EMF) (test level index 3 according to OIML D11) |
| Power frequency for magnetic fields (IEC 61000-4-8) | Continuous 100 A/m Short duration 1 000 A/m for 1 s (test level index 5 according to OIML D11) |

For instruments powered by a road vehicle battery:

| | |
|---|---|
| Electrical transient conduction along supply lines | Pulses 2a, 2b, 3a, 3b, test level IV (ISO 7637-2) |
| Electrical transient conduction via lines other than supply lines | Pulses a and b, test level IV (ISO 7637-3) |
| Load dump | Test B (ISO 16750-2) |

3. Description of the specific technical and design requirements of PN meters.

3.1. Construction

The instrument shall fulfil the specifications detailed below.

- All parts from the exhaust pipe up to the particle detector, which are in contact with raw and diluted exhaust gas, shall be made of corrosion-resistant material

and shall not influence the composition of the gas sample. The material of the sampling probe shall withstand the exhaust gas temperature.

- The PN measuring instrument shall incorporate good particle sampling practices to minimise particle losses.
- The sampling probe shall be designed to enable it to be inserted at least 0.2 m (at least 0.05 m in justified exemptions) into the exhaust pipe of the vehicle and be securely held in place by a retaining device regardless of the depth of insertion and the exhaust pipe shape, size and wall thickness. The sampling probe design shall facilitate sampling at the inlet of the sampling probe without touching the wall of the exhaust pipe.
- The instrument shall either contain a device that prevents water condensation from forming in the sampling and measuring components or a detector that emits an alarm and prevents indication of a measurement result.
- If an adjustment reference is needed due to the measurement technique, simple means to provide this reference shall be available with the instrument.
- If a dilution unit is included in the PN measuring instrument, the dilution factor shall remain constant during a measurement.
- The device conveying the exhaust gas shall be mounted so that its vibrations do not affect the measurements. The user shall be able to switch it on and off separately from the other instrument components. However, no measurement shall be possible when it is switched off. The gas handling system shall be flushed automatically with ambient air before the device conveying the exhaust gas is switched off.
- The instrument shall be equipped with a device that indicates when the gas flow rate is lower than the minimum flow rate and, consequently, the flow decreases to a level that would cause the detection to exceed either the response time or the maximum permissible error under reference operating conditions (see point 2.5 of this Appendix). Additionally, and according to the technology used, the particle detector shall be equipped with temperature, current, voltage or any other relevant sensors that monitor critical parameters for the operation of the PN measuring instrument to remain within the maximum permissible error specified in this Annex.
- The sample preconditioning device shall ensure that the influence of the dilution air on the measurement results does not exceed 5 000·1/cm$^3$.
- It shall not be possible to print a document or store measurement data on an external device (for legal purposes) if the instrument control facilities detect a significant fault or malfunction. The PN measuring instrument interface shall comply with the requirements of OIML D 11 and OIML D 31.
- The PN measuring instrument shall have a reporting frequency equal to or greater than 1 Hz.
- The instrument shall be designed according to good engineering practice to ensure that particle counting efficiencies are stable.

- The PN measuring instrument or device with the relevant software shall allow the logging time defined by the measurement procedure during the periodic technical inspection and report the measurement and test result in accordance with the measurement procedure.
- The PN measuring instrument or device with the relevant software shall guide the user through the steps described in the periodic technical inspection measurement procedure.

3.2. Requirements for ensuring correct operation

- If the detection of one or more of disturbances is achieved by the use of automatic self-checking facilities, then it shall be possible to check the correct functioning of such facilities.
- The instrument shall be controlled by an automatic verification facility that operates in such a way that, before a measurement can be indicated or printed, all settings, and all other verification facility parameters are confirmed for proper values or status (i.e. within limits).
- The measuring instrument shall ensure that:
  (1) it automatically and continuously monitors the relevant parameters that significantly influence the measurement principle used;
  (2) it includes a specific maximum leakage monitoring procedure and prevents measurement if the measured value is greater than 5 000 $(cm^3)^{-1}$;
  (3) where required by the measurement principle, a zero-setting procedure conducted with a HEPA filter at the inlet of the PN measuring instrument, at least with each self-test.

## APPENDIX II

## Technical test procedure for conformity assessment of PN measuring instruments

Conformity assessment of a PN measuring instrument with regard to the requirements applicable to them shall be carried out in accordance with the requirements established in Section 4 of this Annex.

1. Type examination of PN measuring instruments (Module B)

The type examination of PN measuring instruments shall be carried out in accordance with Article 5 of Annex I to Royal Decree 244/2016 of 3 June 2016.

The tests shall be carried out on the complete equipment, to which end the applicant shall provide all parts of the PN measuring instrument together with the necessary supplementary devices.

Together with the equipment, the technical documentation provided for in Article 13 of Royal Decree 244/2016 of 3 June 2016 shall be provided.

- The reference instrument shall be a Faraday cup electrometer or a particle counter with a counting efficiency of > 0.5 at 10 nm (combined with a traceable diluter if necessary for polydisperse particles). The expanded uncertainty of the reference system, including the diluter if applicable, shall be less than 12.5 %.

Verification of compliance with the common essential requirements of the applicable measuring instruments of Annex II to Royal Decree 244/2016 and with the specific essential metrological requirements included in point 2 of Appendix I and the technical requirements specified in point 3 of Appendix I shall be performed.

Efficiency test.

- Counting efficiency shall be determined with monodisperse particles with the sizes defined in point 2 of Appendix I or with polydisperse particles with geometric mean diameter (GMD) as defined in this point and geometric standard deviation (GSD) of less than or equal to 1.6.
- The minimum concentration used for efficiency tests shall be higher than the lower value of the measuring range of the PN measuring instrument divided by the lower counting efficiency defined for each particle size in this point. For example, for a lower value of the measuring range of 5 000 1/cm$^3$ at 23 nm, the concentration of the particles measured by the reference system shall be at least 25 000 1/cm$^3$.
- The counting efficiency tests are performed under reference operating conditions (see point 2.12 of this Appendix) with thermally stable and soot-like particles. If needed, any neutralisation or drying of the generated particles takes place before the splitter to the reference and test instruments. In the case of monodisperse particle testing, the correction for multiple charged particles is not higher than 10 % (and shall be reported).
- If the PN measuring instrument includes any internal adjustment factor, it shall remain the same (fixed) for all tests described in this point.
- The whole PN measuring instrument (i.e. including sampling probe and sampling line, if any) shall fulfil the counting efficiency requirements. At the request of the manufacturer, the counting efficiencies of the PN measuring instrument may be tested in separate parts under representative conditions inside the instrument. In that case, the efficiency of the whole PN measuring instrument (i.e. multiplication of efficiencies of all parts) shall fulfil the counting efficiency requirements.

Linearity test.

- The PN measuring instrument assembly, as a whole or in parts, shall be tested for its linearity with thermally stable, polydisperse soot-like particles with GMD 70 ± 10 nm and GSD lower than or equal to 1.6.
- The reference instrument shall be a traceable particle counter with a counting efficiency of > 0.5 at 10 nm. The reference instrument may be accompanied by a traceable diluter to measure high concentrations, but the expanded uncertainty over the whole reference system (diluter and particle counter) shall be kept below 12.5 % under reference operating conditions.
- Linearity tests are performed with at least nine different concentrations within the measuring range and the maximum permissible error under the reference operating conditions (see point 2.5 of this Appendix) shall be respected.
- It is recommended to include in the test concentrations the lower value of the measuring range, the applicable PN limit (± 10 %), twice the PN limit (± 10 %) and the PN limit multiplied by 0.2. At least one concentration shall be between the PN limit and the higher value of the measuring range, as well as at least three concentrations equally distributed between the point where the maximum permissible error changes from absolute to relative and the PN limit.
- If the device is tested in parts, the linearity check may be limited to the particle detector, but the efficiencies of the rest of the parts shall be taken into account for the error calculation.

Zero-level test.

The zero level shall be measured with a HEPA filter at the inlet.

Volatile particle removal efficiency test.

If necessary, neutralisation of the tetracontane particles shall take place before the splitter to the reference and test instruments. Alternatively, polydisperse tetracontane particles may be used with a GMD of between 30 and 35 nm and a total concentration of between 50 000 and 150 000 1/cm$^3$. In both cases (testing with monodisperse or polydisperse tetracontane particles), the reference system shall fulfil the same requirements as described in point 2.7.

Volatile removal efficiency tests with larger tetracontane particle size (monodisperse) or GMD (polydisperse) or tetracontane concentrations higher than those described in this point may be accepted only if the PN measuring instrument passes the test (removal efficiency > 95 %).

Stability with time or drift test

The PN measuring instrument may not be adjusted during the stability test. Stability measurements shall be performed for at least 12 hours (not necessarily continuously) with a nominal concentration of at least 100 000 1/cm$^3$. The comparison with a reference instrument (with the same requirements as the

reference system described in this point 1 of this Appendix) shall be made at least every hour. A three-hour accelerated stability test with nominal concentration of at least 10 000 000 1/cm$^3$ is permitted. In this case, the comparison with the reference instrument shall be made every hour, but with a nominal concentration of 100 000 1/cm$^3$.

If the instrument is equipped with a means for drift compensation, such as an automatic zero or automatic internal adjustment, the action of those adjustments shall not produce an indication that can be confused with a measurement of an external gas.

Repeatability test

Repeatability shall be tested at a nominal concentration of at least 100 000 1/cm$^3$. HEPA filtered air flow or ambient air flow shall be supplied to the PN measuring instrument between every two consecutive measurements.

Reference quantities test

Point 2.13 of Appendix I sets out the test conditions for influence quantities and the normative reference documents for their performance.

2. Tests for conformity assessment (modules F and D).

These tests shall consist of checking the conformity of each PN measuring instrument manufactured with the type.

The assessment shall include a linearity test with polydisperse particles with monomodal size distribution of GMD 70 ± 20 nm and GSD lower than or equal to 2.1. The linearity check shall be performed with five reference PN samples.

The maximum permissible error is as defined in the reference operating conditions (see point 2.5 of Appendix I).

The concentration of the five reference PN samples shall range from one fifth of the PN limit to twice the PN limit (including those two concentrations, ± 10 %) and includes the PN limit (± 10 %).

The reference system consists of a traceable particle counter with a counting efficiency at 23 nm of greater than or equal to 0.5 or complying with point 2.6 of Appendix I.

The particle counter may be accompanied by a traceable diluter. The expanded uncertainty of the complete reference system shall be less than 12.5 %.

The material used for the verification shall be thermally stable with soot-like particles. Other materials (e.g. salt particles) may be used.

During the verification, the following checks or tests shall be carried out:

- a visual inspection to determine conformity to type of approved PN measurement instrument;
- a check of the power supply voltage and frequency at the location of use to determine compliance with the specifications on the label of the measuring instrument;
- a clean air or leakage test (as described in the operating instructions);
- a zero-level test (as described in point 2.8 of Appendix I) if different from the clean air or leakage check;
- a low gas flow check by restricting the gas flow supplied to the sampling probe;
- a response time check.

## APPENDIX III

## Technical test procedure for verification after repair or modification of PN measuring instruments

The tests for verification after repair or modification for PN meters are the same as for conformity to type based on product verification, as set out in Appendix II to this Annex.

The maximum permissible error is as defined in the reference operating conditions (see point 2.5 of Appendix I).

## APPENDIX IV

## Technical test procedure for periodic verification of PN measuring instruments

The linearity test in the periodic verification of a PN meter is the same as for the conformity to type based on the product verification, as set out in Appendix II to this Annex, except that in this case only the following three concentrations shall be assessed:

one-fifth of the PN limit, the PN limit and twice the PN limit (concentrations within a margin of 20 %).

The maximum permissible error is as defined in the rated operating conditions (see point 2.5 of Appendix I).

The periodic verification test may be carried out at the premises of the authorised verification body or on site.

In addition, during the verification, the following checks or tests shall be carried out:

- a visual inspection to determine conformity to type of approved PN measurement instrument;
- a clean air or leakage check (as described in the operating instructions);
- a zero-level test (as described in point 2.8 of Appendix I) if different from the clean air or leakage check;
- a low gas flow check by restricting the gas flow supplied to the sampling probe;
- a response time check.'

Sole repealing provision. *Repeal of regulations*.

Order ITC/3721/2006 of 22 November 2006 regulating State metrological control at the phase of bringing to market and putting into service of working instruments known as manometers, compound gauges and vacuum gauges with elastic receptor elements and direct reading capabilities that are intended to measure pressure is repealed.

First final provision. *Attribution of powers*

This Order is issued under the provisions of Article 149(1)(12) of the Spanish Constitution, which gives the State exclusive jurisdiction to issue legislation on weights and measures.

Second final provision. *Entry into force*

This Order shall enter into force on the twentieth day following its publication in the Official State Gazette.

Signed in Madrid