

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE



INTERNATIONAL RECOMMENDATION

Barometers

Baromètres

OIML R 97

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FOREWORD

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BAROMETERS

0. Terminology

The metrological terminology of this Recommendation conforms to that of the “International vocabulary of basic and general terms in metrology” (VIM - edition 1984) and the “Vocabulary of legal metrology” (VML - edition 1978). The term “result of measurement” refers to the value of pressure obtained after the indication of the barometer has been corrected as necessary for temperature and gravity.

1. Field of application

1.1. This Recommendation specifies the metrological and technical requirements applicable to instruments for the measurement of ambient atmospheric pressure, and to their calibration, pattern evaluation and initial and subsequent verification. It has relevance to the following types:

- a) mercury barometers having a permanent reference vacuum,
- b) barometers, for example aneroid barometers, with an elastic sensing element, a permanent reference vacuum and an indication, which may be either analogue, with a pointer and a dial, or digital.

1.2. The Recommendation applies to barometers such as those used for:

- a) the direct measurement of pressure in laboratories, industrial plants and meteorological stations,
- b) the calibration of static-pressure measuring instruments of lower accuracy classes and,
- c) the checking and adjustment of altimeters.

1.3. The Recommendation is not intended to apply to instruments of the highest accuracy, such as those used as national or primary standards.

1.4. The Recommendation applies to barometers designed for use in the range of pressures and temperatures generally occurring at locations at sea-level or at modest elevations (– 200 m to + 2 000 m). If the Recommendation is to be applied to barometers to be used at high altitudes, great depths or in special climatic conditions, then some of its provisions must be modified or others added.

2. Units of measurement

2.1. The SI unit of pressure is the Pascal (symbol Pa), which is the special name for the newton per square metre (symbol N/m²).

2.2. In the SI the most suitable preferred multiple of the Pascal for the measurement of ambient atmospheric pressure is the kilopascal (symbol kPa), and its use is recommended (1).

2.3. If the scale of an instrument is not graduated in SI units, then the instruction manual shall include appropriate conversion factors.

3. Applicable pressure range

Because of differences of climate and altitude, the pressure ranges considered normal vary from country to country, and sometimes even from region to region. For example the range 90 kPa to 105 kPa might be normal in one country and 60 kPa to 110 kPa in another. Appropriate pressure ranges must therefore be determined nationally, regionally or even locally.

4. Metrological requirements

4.1. Three accuracy classes of instruments apply for both mercury barometers and barometers with elastic sensing elements. The maximum permissible errors in the result of measurement at the time of verification for each accuracy class of instrument are shown in the following Table.

Instrument class	Maximum permissible error in the result of measurement at the time of verification after application of all necessary corrections for temperature and gravity
0.02	± 0.02 kPa (± 0.2 hPa)
0.05	± 0.05 kPa (± 0.5 hPa)
0.1	± 0.10 kPa (± 1.0 hPa)

Maximum permissible error in service is equal to maximum permissible error in verification.

4.2. Detailed procedures for determining the magnitudes of the various component errors contributing to a barometer's total error are described in Annex A of this Recommendation.

4.3. The values of all the constants, such as thermal expansion coefficients, used in the calculation of pressure and in the determination of corrections shall be given in the instruction manual to an accuracy such that the algebraic sum of the errors arising from their use shall be less than 10 % of the maximum permissible error of the instrument.

(1) Note: The International Civil Aviation Organisation and the World Meteorological Organisation have adopted the hectopascal (symbol hPa) as the unit for altimeter settings and atmospheric pressure measurement. The hectopascal and the millibar are identical in all but name. Many barometers already in existence have scales graduated in the units listed below:

(a) the Torr,

(b) the conventional millimetre of mercury (symbol mmHg),

(c) the conventional inch of mercury (symbol inHg).

The scales of new instruments should be graduated in kPa or hPa, with additional graduations in one or more of the "conventional" units only if required by practical necessity.

It is assumed that the value of the acceleration due to gravity at the location of the instrument is known sufficiently accurately for its contribution to the total error to be insignificant.

5. Technical requirements

5.1. General

5.1.1. The barometer, when protected according to the manufacturer's instructions, shall be capable of withstanding ordinary transportation without breakage and without the introduction of additional errors that would raise the total error beyond the limits given in point 4.1.

5.1.2. If, in order to facilitate calibration and transportation, the construction of the barometer allows the pressure within it to be maintained at a value different from that of ambient pressure, then the tightness of the joint gaskets shall be such that, if the barometer is sealed at a pressure equal to the upper or lower end of the measurement range, the internal pressure shall not change by a value equal to or greater than the maximum permissible error during a period of one minute.

5.2. Mercury barometers

5.2.1. Barometers may be of either the flexible-cistern type, normally having two observable mercury surfaces (for example the Fortin pattern), or of the fixed-cistern type. The latter may have only one observable surface (for example the Kew pattern) or two observable mercury surfaces (for example the Newman pattern).

5.2.2. All materials used in the construction of the barometer that are in contact with the mercury shall be selected to have no significantly detrimental effect on the purity of the mercury.

5.2.3. In the Fortin type of barometer the pointer in the cistern shall be clean and sharp.

5.2.4. The mercury shall be chemically purified, preferably by a procedure that includes acid washing and triple distillation. This procedure shall ensure that the density of the mercury at a temperature of 0 °C and a pressure of 100 kPa shall fall within the limits of $(13\,595.1 \pm 0.1) \text{ kg} \cdot \text{m}^{-3}$. All observable surfaces of the mercury shall be clean and bright, and the meniscus shall be curved downwards at its line of contact with the glass tube (or the cistern) and symmetrical about the cylindrical axis throughout the range of pressure.

5.2.5. The tube shall be constructed of clean, clear glass with the upper end preferably being approximately a hemisphere, which gives the maximum possible mechanical strength. The hemispherical end shall be annealed after forming. The internal diameter of the tube over the scale length shall be at least 8 mm and preferably 9 mm for instruments of accuracy classes 0.02 and 0.05, and at least 6 mm for accuracy class 0.1. The glass tube shall be protected from mechanical damage, for example by a tubular metal sheath appropriately slotted to allow observation of the mercury surface.

5.2.6. If the barometer is intended for marine use, it shall have the bore of the middle portion of the tube reduced, so as to offer resistance to rapid oscillations of the mercury. The length and internal diameter of the middle section shall be such that the time taken for 63 % response to a sudden and permanent change in ambient pressure is within the range 4 to 9 minutes,

5.2.7. For a cistern type, the air space shall be connected to the ambient atmosphere through a porous material, such as boxwood, which confines the mercury but, nevertheless, allows the height of the mercury column to respond rapidly to pressure changes. Except in the case of barometers intended for marine use, the material should be sufficiently porous to allow a 63 % response to a step pressure change

in a time of no longer than 5 seconds. This porous material should be located at the end of a tubular extension to the cistern and be detachable, in order to facilitate the application of various pressures during testing and calibration. When this facility is incorporated, all other joints in the cistern shall be leak free to the extent defined in point 5.1.2.

5.2.8. The scale shall be an integral, not easily removable, material part of the barometer, positioned so as to compensate for the capillary depression of the meniscus and having a coefficient of thermal expansion known to within $\pm 0.5 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$ so that sufficiently accurate temperature corrections may be calculated. The coefficient of thermal expansion of the material used in the construction of the cisterns of fixed-cistern barometers shall also be known with an error not exceeding $\pm 4 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$.

5.2.9. A calibrated thermometer of suitable design, with a scale in degrees Celsius, shall be firmly attached to the barometer with its sensing element in close proximity to the mercury column and approximately half way up it. The error of the thermometer shall not exceed $\pm 0.3 \text{ }^\circ\text{C}$.

5.2.10. The design of a barometer shall allow it to be positioned with its mercury column vertical when in use. For marine use the suspension shall be on gimbals.

5.2.11. The barometer shall be provided with a manual that states its accuracy class and contains detailed instructions regarding its transportation, exposure, mounting, calibration, use and maintenance. The manual shall contain (a) tables of gravity corrections (altitude and latitude) and (b) a table of temperature corrections. The tables shall cover the whole pressure-measurement range, at intervals of not more than 2 kPa (20 hPa), and cover the temperature range over which the barometer may be used, at intervals of not more than 0.5 $^\circ\text{C}$ for an instrument of accuracy classes 0.02 or 0.05, and not more than 1 $^\circ\text{C}$ for accuracy class 0.1. The manual shall also contain the mathematical relationships used in the calculation of pressure as a function of the observables (height of column and temperature) and g , the acceleration due to gravity. The constants to be used in conjunction with the equation shall also be given, i.e., the density of mercury at 0 $^\circ\text{C}$, the volume coefficient of thermal expansion of mercury, the linear coefficient of thermal expansion of the scale material, and, when appropriate, the linear coefficient of expansion of the material used in the construction of the reservoir. A statement, that the magnitude of the gravity correction depends on the location, shall also be included. See also point 2.3.

5.2.12. For barometers having automatic devices for displaying or recording the mercury level and for calculating the pressure, appropriate instructions for entering the necessary constants, such as g , shall be provided.

5.3. Barometers with elastic sensing elements

5.3.1. The elastic element of the barometer may be of any suitable shape, (for example, a bellows, a diaphragm or a Bourdon tube) and may be constructed of any material compatible with the performance requirements of this Recommendation.

5.3.2. For applications subject to metrological control the instrument shall be constructed so that the mechanism and, in particular, any means of adjusting the zero or sensitivity, shall not be easily accessible to the user.

5.3.3. The scale or readout shall show unambiguously pressure values in units that are in accordance with the requirements of point 6.2.

5.3.4. The instrument shall incorporate some means of temperature compensation, for example a bi-metallic strip in the mechanism, so that the performance requirements stated in point 4.1 shall be fulfilled at least in the temperature range for which the instrument is intended to be used.

- 5.3.5. The application of pressures during the calibration and testing of the instrument shall, as far as possible, be facilitated by suitable provisions in its design. For example, for certain barometers the mechanism may be enclosed in an air-tight case with a window for making observations, so that the pressure may be applied to the sensing element through a venting tube, which should allow the attachment of a damping cap to its end if necessary. When this facility is incorporated, all other joints in the system shall be leak-free to the extent defined in point 5.1.2.
- 5.3.6. Instruments of designs that have been found to be susceptible to damage as a result of the application of pressures beyond the extremes of the working range shall be provided with overload stops, so that they may be transported by air without the need for special precautions.
- 5.3.7. Barometers employing electrical or electronic components that may affect their measurement characteristics shall be designed and constructed so that power-line voltage fluctuations or any conducted or radiated electromagnetic interference shall not cause an error greater than 25 % of the maximum permissible error. The guidance given in the International Document OIML D 11 "General requirements for electronic measuring instruments" should be followed.
- 5.3.8. The barometer shall be provided with a manual that contains detailed instructions regarding transportation, installation, calibration, use and maintenance. The manual shall also contain a table of temperature corrections if necessary. See also point 2.3.

6. Graduation

6.1. Mercury barometers

- 6.1.1. The scale shall be graduated at intervals of 0.1 kPa (1 hPa); a vernier or micrometer shall be attached that allows pressure readings to be made to 0.01 kPa (0.1 hPa) or less. If a vernier is used the zero mark shall not be the bottom of the vernier.
- 6.1.2. Each scale shall be clearly and indelibly marked with the relevant unit of pressure measurement.
- 6.1.3. The attached thermometer shall have a scale graduated in intervals of 1 °C or less.

6.2. Barometers with elastic sensing elements

- 6.2.1. These barometers shall be provided with a digital or analogue readout (or a combination of the two) that allows pressure readings to be made directly to 0.01 kPa (0.1 hPa) or less for instruments in accuracy classes 0.02 or 0.05, and to 0.02 kPa (0.2 hPa) or less for instruments in accuracy class 0.1. If the instruments have an analogue output, the design of the scale and pointer shall comply with the recommendations of point 5 of the International Recommendation OIML R 17 "Indicating pressure gauges, vacuum gauges and pressure-vacuum gauges".
- 6.2.2. If an instrument's indication is digital, the height of the digits shall not be less than 3 mm. If the digits are formed from a combination of bars and/or dots, for example of light-emitting diodes, means shall be provided for checking that all the elements are functional. In the event of a power failure the display shall either cease to indicate or display a warning sign.
- 6.2.3. The instrument shall be clearly and securely marked with the relevant unit of pressure. If the instrument has a dial and pointer, the marking shall be on the dial.

7. Additional markings

7.1. All barometers, whether mercury or with elastic sensing elements, shall be clearly and indelibly marked with a unique serial number, the manufacturer's name, the year of manufacture, the pattern designation, number or code and, if appropriate, the verification markings. Such markings should be distinct from the scale in order to avoid confusion.

7.2. Mercury barometers

Mercury barometers shall be clearly and indelibly marked with the following legend:

“Standard conditions: 0 °C, $g = 9.806 65 \text{ m/s}^2$ ”

Barometers of the fixed-cistern type shall also be clearly and indelibly marked with the V/A value in millimetres, irrespective of the units in which the scale is graduated. (The quantity V/A is the quotient of the total volume of mercury in the barometer and the effective area of the horizontal cross-section of the cistern).

7.3. Barometers with elastic sensing elements

7.3.1. Barometers with elastic sensing elements shall be clearly and indelibly marked to indicate the operating position (attitude with respect to the vertical) and the pressure range.

7.3.2. If a correction for temperature is necessary that fact shall be indicated in a prominent place.

8. Metrological controls

8.1. Types of metrological controls

If any country's internal legislation requires that for certain applications a barometer is subject to metrological controls, such controls shall include one, two or all of the following types:

pattern evaluation,
initial verification, and
subsequent or periodic verifications.

8.2. Pattern evaluation and approval

8.2.1. Any new or modified design of barometer that is intended for applications subject to metrological controls shall first be subjected to pattern evaluation by an appropriate authority.

8.2.2. Patterns shall be evaluated to ascertain that they comply with the relevant requirements of this Recommendation. At least 5 instruments shall be evaluated by means of the following:

- i) examination of the instruments, to ensure that they are soundly constructed and that they comply wherever appropriate with point 5 of this Recommendation,
- ii) examination of the graduations and markings, in order to ensure that wherever appropriate they comply with the requirements in points 6 and 7 of this Recommendation,
- iii) evaluation of the metrological performance of the instruments, in order to ensure that the errors do not exceed the maximum values permitted for the intended accuracy class, as specified in points 4 and 8.2.6 of this Recommendation.

8.2.3. The evaluation shall be carried out under conditions that comply with point A.2 in Annex A of this Recommendation, and using equipment complying with point A.3.

8.2.4. The performance tests shall be carried out over essentially the whole working pressure range of the instruments and shall consist of an adequate number of tests, each at an adequate number of test pressures, to provide a statistically significant estimate of the magnitude of the errors, which include contributions due to:

- a) scale graduation errors,
- b) setting errors,
- c) reading errors,
- d) hysteresis errors,
- e) errors due to changes in ambient temperature,
- f) errors in the associated thermometers, if fitted,
- g) errors due to vibration,
- h) any other errors affecting repeatability or reproducibility, such as those arising from electromagnetic interference.

A separate error determination shall be made for each test point by approaching it from both higher and lower pressures, unless earlier tests indicate that a less stringent procedure is adequate.

8.2.5. The testing authority shall determine the bias error, repeatability, hysteresis and stability at each test pressure and temperature.

8.2.6. The performance of a pattern of instrument shall be considered satisfactory only if, after the application of all necessary corrections for temperature and gravity, the following conditions have been met at each test pressure and temperature and for each instrument tested:

- i) Error in the result of measurement

For each observation at each test pressure and temperature during verification the error in the result of measurement shall not exceed the maximum permissible error, as specified in point 4.1.

- ii) Linearity of response

The mean values of the errors obtained under conditions of increasing pressure shall not vary by more than the maximum permissible errors over any interval of 10 kPa or less. Likewise, the mean values of the errors obtained under conditions of decreasing pressure shall not vary by more than the maximum permissible error over any interval of 10 kPa or less.

- iii) Hysteresis

The absolute value of the hysteresis error, defined as the mean error obtained under conditions of decreasing pressure minus the mean error obtained under conditions of increasing pressure, shall not exceed half the maximum permissible error, and the hysteresis error of barometers with elastic sensing elements shall not be negative.

- iv) Stability

When testing barometers with elastic sensing elements, at each test pressure the difference between the means of the errors obtained under conditions of increasing pressure on two different days shall not exceed 33 % of the maximum permissible error. Likewise the difference between the means of the errors obtained under conditions of decreasing pressure on two different days shall not exceed 33 % of the maximum permissible error.

- v) Each of the above provisions shall be met independently of any other provisions; compliance with any one of these requirements shall not be interpreted as satisfying any other requirement.

8.2.7. If the results of the first series of pattern evaluation tests are satisfactory, a second series shall be carried out after a period of 6 or more months, in order to assess the long-term stability of the instruments. The long term stability shall be considered satisfactory if the errors after 6 months do not differ from the previously determined values by more than 50 % of the maximum permissible errors.

8.2.8. If the results of the second series of tests are also satisfactory and the pattern is considered worthy of approval, the testing authority shall then, according to national requirements:

- i) define procedures for the initial and subsequent verifications of instruments of the tested pattern,
- ii) decide upon a maximum time interval between verifications. In making the decision, consideration should be given to the stringency of the application, the expected frequency of use, the conditions under which the instrument is housed and the extent to which it will be transported,
- iii) issue a pattern approval certificate containing the following information:
 - a) the name of the testing authority,
 - b) the manufacturer's name,
 - c) the pattern designation number, name or code,
 - d) the assigned accuracy class of the pattern and the corresponding maximum error at the time of verification and in service after the application of appropriate corrections,
 - e) a brief description of the instrument and its function,
 - f) the pressure range of the examination,
 - g) the temperature range of the examination,
 - h) a brief description of the metrological tests carried out during the evaluation,
 - i) the traceability of the standards used in the evaluation,
 - j) any special limitations on the use of the instrument,
 - k) the procedures for verification,
 - l) the date of completion of the evaluation,
 - m) the maximum time interval between verifications.

8.3. Verification

8.3.1. Only barometers of an approved pattern shall be eligible for verification.

8.3.2. A barometer shall be verified initially and subsequently by a qualified and accredited authority and, according to national requirements, by means of the following:

- i) an examination of the instrument to ascertain that it is in good condition and to check whether its construction, graduation and markings conform to an approved pattern,
- ii) a check that the prescribed documents are in order,
- iii) a test of the metrological performance of the instrument, as specified in the pattern approval certificate, and following the recommendations in Annex A,
- iv) an assessment of the errors, as specified in the pattern approval certificate, to check for conformity with the intended accuracy class, as specified in points 4 and 8.2.6,
- v) the issue of a verification certificate or the application of a verification mark to the instrument, or both, in accordance with the national requirements.

8.3.3. If a barometer is repaired it shall be reverified before further use.

8.4. Certificate of verification

The certificate of verification of an instrument shall, according to national requirements, include the following:

- i) the name of the approved testing authority that performed the tests,
- ii) the name of the owner of the instrument,
- iii) the name of the manufacturer,
- iv) the designation, number or code of the approved pattern with which it conforms,
- v) the number, date and origin of the pattern approval certificate,
- vi) the assigned accuracy class,
- vii) a brief description of the barometer,
- viii) the serial number of the instrument,
- ix) the serial number of the associated thermometer, if fitted,
- x) the year of manufacture, if known,
- xi) the pressure range of the verification,
- xii) the temperature range of the verification,
- xiii) a brief description of the verification tests,
- xiv) the traceability of the standards used in the verification,
- xv) any special limitations on the use of the instrument, for example the temperature range outside which its verification is invalid,
- xvi) the date of completion of the examination,
- xvii) the date at which the verification certificate becomes invalid,
- xviii) a copy of the calibration report.

These requirements are summarised in Annex B.

ANNEX A

CALIBRATION AND TEST PROCEDURES

A.1. General requirements

A.1.1. In order to realise the full measurement capability of a barometer it should be calibrated before use and recalibrated at regular intervals during service. This applies to all barometers, even those not intended for use in an application subject to metrological control.

A.1.2. If a barometer has been repaired, it shall be recalibrated. Otherwise, the interval between re-calibrations shall be decided according to the considerations in point 8.2.8.ii).

A.2. Calibration conditions

A.2.1. The calibration equipment and the barometers under test shall not be in direct sunlight. Any vibrations or surges in ambient pressure shall not cause an error greater than 25 % of the maximum permissible error.

A.2.2. The temperature during calibration shall be within the range in which the barometer is intended for use and shall be held constant to within ± 1 °C. If, however, it is foreseen that the barometer will be used at temperatures more than 5 °C above or below that of the calibration laboratory then, unless pattern evaluation tests have indicated otherwise, additional tests are required at appropriate temperatures in order to determine the necessary corrections.

A.3. Calibration equipment

A.3.1. After the application of all necessary corrections, the error in the results of measurement of the reference standard or working standard used for the calibration shall not exceed 25 % of the maximum permissible error of the instrument being calibrated. The calibration of the standard shall be traceable to national standards.

A.3.2. In order to comply with this Recommendation barometers shall be calibrated for both increasing and decreasing pressures over essentially the whole of their working pressure range. Therefore the full range of test pressures must be applied in a controlled manner, beyond what might be achieved with natural atmospheric pressure changes. If a barometer does not have a venting tube, such as described in point 5.2.7, it shall be calibrated in a test chamber in which the pressure can be varied progressively over the whole of the working range of the barometer. During the taking of observations the rate of variation of the applied test pressure shall not exceed $10 \text{ Pa} \cdot \text{min}^{-1}$.

A.3.3. The reference standards or working standards used for the calibration of any thermometer associated with the barometer shall cover the whole range of the thermometer and, after the application of all necessary corrections, shall not have a measurement error greater than ± 0.1 °C.

A.4. Preliminary checks

A.4.1. Prior to calibration all barometers and their associated thermometers shall be examined to ensure that they are in good condition and that their construction, graduation and markings comply with points 5, 6 and 7 of this Recommendation.

A.4.2. Mercury barometers should be checked, if possible and prior to calibration, for the absence of any significant amount of air in the vacuum space above the mercury. This test is often done by listening for the sound of a metallic “click” when the barometer is gently tilted.

A.4.3. When applicable, the barometer shall be tested for leak-tightness according to the requirements of point 5.1.2. The leak-rate shall be checked 3 times, each leak test being of not less than 5 minutes duration.

A.4.4. If necessary, and with the mutual agreement of the calibrating authority and the owner, the scale of the barometer or the amount of mercury in its reservoir may be adjusted, to reduce the error of measurement. Such an adjustment is permissible only after a preliminary check and prior to a complete calibration. An adjustment shall not be made during or after the final calibration.

A.5. Calibration procedure

A.5.1. General

A.5.1.1. Barometers submitted for calibration shall be subjected to the ambient conditions of the calibration laboratory for at least 10 hours before the calibration commences.

A.5.1.2. Throughout the calibration the instrument shall be operated according to the instructions in the manual provided.

A.5.1.3. The number of test pressures shall depend on the linearity of the instrument as indicated by experience or by pattern evaluation tests; however, instrumental corrections shall be determined for at least four test pressures distributed throughout the instrument's range and separated by pressure intervals not exceeding 5 kPa. One of the test pressures shall be 100 kPa if this pressure is within the limits of measurement of the instrument. Each calibration cycle shall include a series of observations taken in a sequence of progressively increasing pressures and a series taken in a sequence of progressively decreasing pressures. Between test points the pressure shall be changed gradually, at a rate not exceeding 0.5 kPa per minute, and shall be held essentially constant for at least 5 minutes prior to taking observations.

A.5.1.4. The associated thermometer, if supplied, shall be calibrated over the whole of the specified working temperature range of the barometer at temperature intervals not exceeding 10 °C.

A.5.2. Mercury barometers

A.5.2.1. The barometer shall be gently tapped prior to each observation.

A.5.2.2. For instruments in either accuracy classes 0.02 or 0.05 the test cycle shall be repeated to provide two complete sets of observations.

A.5.3. Barometers with elastic sensing elements

The calibration shall take the form of two cyclic pressure tests, preferably carried out on different days.

A.6. Calibration report

The report on the calibration of an instrument shall include the following information:

- i) the name of the testing authority,
- ii) the name of the owner of the barometer,
- iii) the manufacturer's name,

- iv) the pattern designation, number or code,
- v) the assigned accuracy class,
- vi) a brief description of the barometer,
- vii) the serial number of the instrument,
- viii) the serial number of the associated thermometer, when fitted,
- ix) the year of manufacture, if known,
- x) the pressure range of the examination,
- xi) the temperature range of the examination,
- xii) a brief description of the tests,
- xiii) the traceability and maximum measurement error of the pressure and temperature standards used in the calibration,
- xiv) the corrections at each test pressure, calculated by taking the mean of the values obtained for both increasing and decreasing pressures,
- xv) in the case of barometers with elastic sensing elements, the hysteresis at each test pressure, expressed as the difference between the mean values of the errors for decreasing pressures and the mean values of the errors for increasing pressures at each test pressure,
- xvi) the corrections to be applied to the attached thermometer, when fitted,
- xvii) the date on which the calibration was completed,
- xviii) the recommended date for re-calibration.

These requirements are summarised in Annex B.

ANNEX B

SUMMARY OF RECOMMENDATIONS FOR INFORMATION REQUIRED ON DOCUMENTS

Note: These requirements may vary according to national regulations

Information required	Pattern approval cert.	Verification certificate	Calibration report
Name of testing authority	+	+	+
Name of barometer owner	0	+	+
Name of manufacturer	+	+	+
Pattern designation number or code	+	+	+
No., date and origin of pattern approval cert.	0	+	0
Assigned accuracy class	+	+	+
Brief description of the barometer	+	+	+
Serial number of barometer	0	+	+
Serial number of associated thermometer	0	+	+
Year of manufacture	0	+	+
Pressure range of examination	+	+	+
Temperature range of examination	+	+	+
Brief description of tests	+	+	+
Traceability of standards used	+	+	+
Corrections of barometer	0	0	+
Corrections of associated thermometer	0	0	+
Limitations on use	+	+	0
Procedures for verification	+	0	0
Date of completion of examination	+	+	+
Recommended maximum examination interval	+	+	+
Copy of the calibration report	0	+	+

+ required
0 not required