InfoMil

Factsheet L40-7C AIR

Quality assurance of automated measuring systems

Continuous measurements

This factsheet is part of the L40 series "Measurement of air emissions". L40 consists of a manual that deals with the background of the measurement of air emissions and a series of factsheets that per component consider the specific quality-determining aspects of the measurement in question. These main quality aspects can be found in the checklists on p. 7 and 8. The factsheets and the manual serve to support the competent authority. You can use them in the assessment of the quality of air measurements.

The right factsheet?

In the factsheets a distinction is made between periodic measurements and continuous measurements with automated measuring systems. This factsheet focuses on the assessment of the quality assurance of automated measuring systems within the framework of the NEN-EN 14181 standard. When this standard is not prescribed, the factsheet on continuous measurements for the component in question applies. Note that for the assessment of parallel measurements within the framework of NEN-EN 14181 you are referred to the factsheet on the periodic measurement in question.

If you have any questions concerning this factsheet, please surf to website www.infomil.nl. You can also contact the helpdesk, telephone +31 (0)70 373 55 75, e-mail helpdesk@infomil.nl. You can find the opening hours on the website.

Background

NEN-EN 14181

Stationary source emissions – Quality assurance of automated measuring systems.

NEN-EN 14181 is focused on the quality assurance of measurement results of automated measuring systems (AMS). The standard does not prescribe specific measurement principles, but provides procedures to assure that the measurement results can meet a specific uncertainty requirement.
For a number of components, the systematics of NEN-EN 14181 is further worked out in a separate standard, such as for particulate matter in NEN-EN 13284-2 and for mercury in NEN-EN 14884.

NEN-EN 14181 has been specifically written for measuring systems with an analyser for the direct measurement of the concentration of a component in the flue gas (CEMS, *Continuous Emission Monitoring System*). In a number of cases, the law and regulations also permit the performance of continuous measurements with PEMS (*Predictive Emission Monitoring System*). The concentration of a component is then calculated with the values of a number of relevant operation data and a mathematical model developed for that specific purpose. The model and the choice of operation parameters to be measured continuously must be such that they can unambiguously establish the concentration of the component in question in the flue gas. The consequences of applying the NEN-EN 14181 systematics on PEMS are elaborated under Main quality aspects. The testing of the PEMS itself (whether all relevant parameters have been included properly) falls outside the scope of this factsheet.

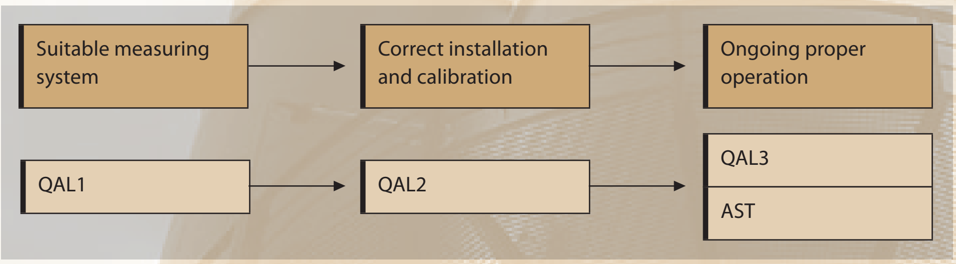
Principle

NEN-EN 14181 gives three quality assurance levels (QAL1, QAL2 and QAL3) and an annual inspection (Annual Surveillance Test, AST).[1] With the aid of the procedures described in these levels, the whole process is assured, from the choice of a suitable measuring system, calibration and validation of the measuring system following installation, up to and including the monitoring of the ongoing proper operation of the measuring system.

The uncertainty requirement against which testing is performed is not included in the standard.
The maximum permissible uncertainty of the measurement results is determined by "the client"; in environmental measurements by the government. The requirements for continuous air emission measurements are therefore specified in the law and regulations, such as the Decree on emission limits for combustion plants A *(Besluit emissie-eisen stookinstallaties, BEES A)*, the Decree on waste incineration *(Besluit verbranden afvalstoffen, Bva)* and the Decree on emissions trading *(Besluit handel in emissierechten)*.
For example, for continuous NO_x emission measurements BEES A specifies a maximum uncertainty of 20% of the emission limit value (20% of 200 mg/m_0^3 => 40 mg/m_0^3), expressed as 95% confidence interval. Note that in the Decree on emissions trading the uncertainty requirement is not expressed as percentage of the emission limit value, but as percentage of the year average concentration of the installation in question.

[1] In the Dutch version of NEN-EN 14181, the concept of QAL is translated as KBN (kwaliteitsborgingniveau) and the concept of AST as JC (jaarlijkse controle).

Diagram of the quality assurance procedures in accordance with NEN-EN 14181



QAL1 is a once-only procedure where it is evaluated whether a measuring system (sampling and analysis system) can meet the uncertainty requirement as specified in the law and regulations. The procedure is laid down in NEN-EN-ISO 14956: Air Quality – Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty. This procedure is generally carried out by the manufacturer or supplier of the measuring equipment within the framework of certification or type approval.

On the basis of the technical characteristics of the measuring system and the conditions under which the measuring system will operate, an estimate is made of the uncertainty of the measurement result. The outcome of the estimate is tested against the specified uncertainty requirement. First, all uncertainty sources are identified, the size of the uncertainty quantified per source, and then all individual uncertainties are combined to form the total uncertainty..

Main quality aspects

1 The QAL1 report must show whether the used measuring instrument can provide suitable measurement results under all normally occurring operating conditions. The QAL1 report therefore contains, in addition to an overview of the relevant uncertainty sources (linked to the performance characteristics of the measuring instrument) insight into the variations that can occur in the operating conditions. In principle, the procedure is carried out at a test value that corresponds with the emission limit value. Within the framework of NO_x emissions trading, however, the year average NO_x concentration is used as test value.

Examples of relevant uncertainty sources for a CEMS are:
- Representativeness of sampling (possible concentration profiles)
- Influence of sample transport and conditioning (possible loss of component)
- Repeatability or reproducibility at zero concentration
- Repeatability or reproducibility at test value
- Drift
- Deviation from linearity
- Influence of interfering components
- Influence of ambient temperature and pressure
- Influence of mains voltage variation
- Influence of uncertainty of control gasses that are used during QAL3
- Uncertainty in the determinations of T, P, moisture and oxygen content (for the conversion to standard conditions)

Operation-specific conditions for a CEMS:
- Size of process variations (influencing of concentration profiles)
- Level / variation in concentration of disturbing components
- Level / variation in ambient temperature and pressure
- Variation in mains voltage
- Quality of control gasses

Examples of relevant uncertainty sources for a PEMS are:
- The uncertainty of the instruments used to measure the input data for the model
- The uncertainty of the model
- For gas turbines, the uncertainty due to the deviating air conditions with respect to the conditions when the model was set up

2 The sampling is often an important source of measurement uncertainty. When the measurement body that performs the QAL2 procedure does not detect any significant concentration differences across the cross-section of the stack (concentration profile), the influence of this source is negligible. When there is a constant concentration profile, this is, in principle, corrected by the calibration (QAL2). Changes of the concentration profile over time, for example due to variation in operation, are, however, not corrected and must therefore be included as an uncertainty source in QAL1.

3 With the procedure in accordance with NEN-EN-ISO 14956, the measurement uncertainty of measurement values is obtained without a possible conversion to standard conditions being taken into account. When a conversion is required, it must be included in the QAL1 procedure. This is, for example, the case in BEES A, where the uncertainty requirement is related to the emission limit value at standard conditions (concentrations at T=273 K, P=101.3 kPa, in dry flue gas and possibly at standard oxygen percentage). The determination of the additional measurement data (temperature, pressure, moisture and oxygen content) are then possible sources of uncertainty.

4 Data on the performance characteristics of the measuring instrument can be based on the manufacturer's specifications or on tests within the framework of type approval, such as the TÜV quality mark in Germany and the MCERTS quality mark in Great Britain. These information sources will usually contain no data on the operating conditions under which the measuring instrument must function.

5 The total uncertainty of the measuring instrument, such as is established during QAL1, must be tested against the uncertainty requirement as specified in the law and regulations. This requirement is given as a percentage of the emission limit value or year average concentration, expressed as 95% confidence interval. The uncertainty determined in QAL1, expressed as standard deviation (s), must therefore be multiplied by a factor 2 (formally 1.96) to make a comparison possible.

6 During QAL3 it will be checked with the aid of control gasses (or an alternative procedure for PEMS) whether during the year the measuring instrument meets the set uncertainty requirement. The criteria for this procedure are determined during QAL1 (see QAL3/2).

7 The response time of a measuring system is determined by various factors, such as the residence time of the sample and the electronic time constant of the measuring system.
The influence of the response time on the measurement result is dependent on the speed at with the concentration changes take place in the process and the smallest averaging time over which a measurement value must be given. According to NEN-EN-ISO 14956, the response time must be smaller than 25% of the shortest time period over which, in accordance with the law and regulations, an average concentration must be determined. For highly dynamic processes, 10% should be used.

QAL2 gives the procedures for the periodic calibration and validation of the automated measuring system after it has been installed and functional tests have been performed (see AST). The calibration takes place through a series of minimally 15 parallel measurements that are performed simultaneously with the automated measuring system and by a measurement body with the standard reference method (SRM) for the component in question. The relation between the measurement results of the automated measuring system and of the SRM is recorded in a calibration function and this function is used to correct the measurement values of the automated measuring system. The measurement values are also subjected to a so-called variability test.

The standard describes the calibration without considering a possible conversion to standard conditions. When a conversion is required, it is recommended to include it in the calibration. This is, for example, the case in BEES A, where the emission limit values are given at standard conditions (concentrations at T=273 K, P=101.3 kPa, in dry flue gas and possibly at standard oxygen percentage). In this way, any errors in data processing procedures, such as calculations in relation to corrections for moisture content and oxygen content, are included in the calibration.

In situations where the measurement values lie far below the emission limit value, the performance of a full calibration is less useful. It can be performed in a limited way (see, for example, NEN-EN 13284-2 and NEN-EN 14884).

Main quality aspects

1 According to NEN-EN 14181, QAL2 must be performed minimally every five years or with a frequency as prescribed in the law and regulations. BEES A, Bva and the Decree on emissions trading prescribe once every three years. Apart from certain functional tests, the systematics is the same for CEMS and PEMS.

2 Prior to calibration it must be examined whether the measuring system is installed properly and operates normally. The results of these functional tests (see AST for an overview) must be documented. In case of deviations that can affect the quality of the measurement data, the operator must undertake corrective and preventive actions.

3 During calibration, minimally 15 parallel measurements are performed with the measuring system and with the standard reference method for the component in question (SRM, see QAL2/5). The measurements must be distributed evenly over at least three working days. The three working days need not be consecutive, but must lie within a period of four weeks. It is recommended during the calibration to vary the concentration of the component in question as much as possible within the normally occurring operating conditions. This will prevent that later too many measurement values will fall outside the valid calibration range and hence make a new QAL2 necessary (see QAL2/9 and 11).

4 The law and regulations can specify that a measurement body must be accredited on the basis of NEN-EN-ISO/IEC 17025 or 17020 or that it must apply these standards in a demonstrable way. The standards contain the requirements that a measurement body must meet when it wants to demonstrate that it works in accordance with a quality system, is technically competent and is able to provide technically-valid results. In the Netherlands, accreditation takes place by the Council for Accreditation (Raad voor Accreditatie, RvA). Accreditation by comparable foreign agencies is also recognised. Please note, the accreditation is related to a scope. The scope states for which type of measurement the accreditation is valid.

5 The standard reference methods (SRM) for performing parallel measurements are often prescribed in the law and regulations. The InfoMil site gives an overview of these measurement methods. With the aid of the factsheet on the periodic measurement for the component in question it can be checked whether these measurements are performed by the measurement body in accordance with the measurement standard. Any conversion measurements must also be performed with the SRM in question.

6 The parallel measurements with the SRM must be performed including sampling. This means that the measurement body performing the SRM measurements must itself draw a representative sample from the stack and may not use the company's sampling system. In this way, any concentration profile can be identified and corrected. In practice, the measurement facilities are not always adequate to make the above possible. If this is the case, arrangements must be made with the operator concerning necessary modifications.

7 The automated measuring system and the measurement body that performs the SRM must record average observations at precisely the same time intervals. The sampling time for each parallel measurement should minimally be half an hour or minimally four times the response time of the automated measuring system. In general, the sampling time is equal to the shortest averaging period for which an emission limit value has been set. The time between the start of 2 consecutive measurements should be at least 1 hour.

8 The results of the automated measuring system and of the measurement body by means of the SRM must be expressed in the same units and under the same conditions in order to avoid double conversions and other calculation errors. On the basis of the results of the parallel measurements, a calibration function $y = a + bx$ is established in accordance with the procedure in NEN-EN 14181. Here x is the "bare" read-out and y the calibrated measurement value of the automated measuring system. Data from previous calibrations may not be used for establishing a new calibration function. The calibration function must be used to determine the emission concentrations. This generally means that the values of a and b from the calibration function must be taken over in the programme that is used to calculate the emission concentrations. Here the earlier used values of a and b must be dealt with correctly (do not perform a double correction!).

9 The calibration function is valid within a certain concentration range that runs from zero to the maximum calibrated concentration of the automated measuring system plus 10% of this maximum value. Measurement values outside the valid calibration range are permitted to a limited extent (see QAL2/11 and QAL3/3).

10 The dispersion of the values of the automated measuring system with respect to the calibration function is called the variability. The variability is tested against the uncertainty requirement as specified in the law and regulations.

11 When there are clearly distinguishable types of operations that lead to a clearly different flue gas concentration (e.g. due to varying fuels), a separate QAL2 must be performed for each type of operation. Furthermore, QAL2 must be repeated when it appears that too many measurement values fall outside the valid calibration range (see QAL3/3). Measurement values outside the valid calibration range have an insufficiently-assured quality and are invalid within that framework. However, these values are not excluded from testing against the emission limit value.

QAL3 describes the ongoing quality control that is performed by the operator in order to demonstrate that the automated measuring system continues to operate within the specified uncertainty requirement. According to the standard this is done by means of periodic zero and span checks, tests where an inert zero gas and a control gas with a known concentration of the component in question (the span gas) are provided to the measuring system The response of the measuring system is recorded with the aid of a control chart and the results are subjected to a certain criterion. In this way, deviations in drift and/or precision of the measuring system with respect to the situation during QAL1 can be detected. Adjustments of the zero value and/or span value by the operator or maintenance of the measuring system (e.g. by the supplier) may be necessary due to the results of the evaluation.

Main quality aspects

1 The frequency of the QAL3 checks must be aligned to the period over which the drift is specified in QAL1. Because it concerns an ongoing quality control, once per two weeks is a minimum frequency.

CEMS are checked by providing a zero gas (without the component in question) and a control gas (with known concentration of the component in question). This procedure is known as a zero and span check. The concentration of the control gas should be around 80% of the measuring range. Each control gas bottle must be provided with an analysis certificate.

In a PEMS, tests with a control gas are by definition not possible. In some in-situ measuring systems, the providing of a zero and control gas is also difficult. In the documentation for the implementation of NEN-EN 14181 within the framework of NO_X emissions trading (see More information) two alternative methods are worked out for such situations. In the inspection on the basis of a reference situation of the operating conditions (REFBO), an operating situation is defined that is expected to occur with great regularity during the year. The characteristic operation parameters of the REFBO are recorded.
Each time that a QAL3 procedure is performed it is established whether the REFBO occurred over the past period and which NO_X concentration was then ascertained by the automated measuring system. Care must be taken that the parameters used to define the REFBO do not occur as parameters in the measuring system. In the other method, the model input parameters (MIP) are checked. In this method, the value of the input parameters of the model is compared with the value of another, independent parameter. This independent parameter is related to the input parameter, but is not part of the calculations with the model. Generally flow rate measurements, temperature measurements and other process measurements are performed in duplicate, which provides the possibility to check the input parameters of the PEMS by comparison with an independent measuring instrument.

2 The response of a CEMS to the zero gas and the control gas must be entered in the control charts for the zero value and the span value. The results are then subjected to a certain criterion (see QAL1/6), whereby deviations in drift and/or precision in relation to the situation during QAL1 can be detected. For the zero values this takes place on the basis of S_{AMS} (zero) and for the span values on the basis of S_{AMS} (span). These rejection criteria follow from QAL1. Here only a part is used of all data that is applied for the calculation of the total measurement uncertainty. Because no real samples are involved during QAL3 but control gasses, the influence of the sampling and interfering components, for example, can be disregarded.

PEMS checks (REFBO or MIP) are recorded in a similar way. Shewart or CUMSUM charts are examples of control charts. Both types of charts indicate when the deviations are of such a size that maintenance of the measuring system is necessary. The advantage of the CUSUM chart is, however, that drift and precision are evaluated separately. When only the drift shows an improper deviation, an adjustment of the zero value and/or the span value can be made by the operator.

3 Part of the ongoing quality control is that the operator checks on a weekly basis how many measurement values fall outside the valid calibration range. In the following cases, QAL2 should be repeated within 6 months:

- When per week for a period of more than five weeks over 5% of the measurement values lie outside the valid range of the calibration function.
- When in a week over 40% of the measurement values lie outside the valid range of the calibration function (see QAL2/9 and 11).

AST The AST gives the procedure for the annual inspection to determine whether the automated measuring system is still operating within the specified uncertainty requirement as demonstrated during the QAL2 procedure and whether the calibration function is still valid.

During the AST, an extensive set of functional tests are carried out that, on the one hand, is focused on the condition of the equipment and, on the other, on the procedural aspects and the results of the ongoing quality control of the previous year. The standard specifies that the functional tests must be performed by an experienced testing laboratory. In view of the nature of these tests it is likely that several types of organisations will be involved in performing the tests: calibration laboratories, measurement bodies for emission measurements, maintenance organisations, suppliers and inspection organisations. It is therefore recommended to draw up a performance plan.

In addition, a limited series of minimally five parallel measurements are performed with the automated measuring system and by a measurement body with the standard reference method (SRM) for the component in question. The results of these measurements are subjected to a variability test and a test on the validity of the calibration function.

Functional tests Part / aspect	**Extractive CEMS[2)]**	**In-situ CEMS[3)]**
Alignment and cleanliness (visual inspection)		x
Sampling system (visual inspection)	x	
Documentation and reports (logs, maintenance reports, QAL3 documentation, etc.)	x	x
Serviceability (safe working environment, good access to AMS, etc.)	x	x
Leak test	x	
Zero and span check	x	x
Linearity	4)	4)
Influence of interfering components	4)	4)
Zero and span drift (audit QAL3 data)	4)	4)
Response time	x	x
Report of the functional tests	x	x
Functional tests Part/aspect	**PEMS**	
Instrument-specific tests	x	
Documentation and reports (logs, maintenance reports, QAL3 documentation, etc.)	x	
Serviceability (safe working environment, good access to measuring instruments, etc.)	x	
REFBO or MIP checks (audit QAL3 data)	4)	
Report	x	

2) AMS with a sampling system with which a representative flue gas sample is drawn, which is then analysed outside the stack.
3) AMS with which the flue gas composition is measured directly in the stack.
4) This test is performed exclusively during the AST.

Main quality aspects

1 The AST is carried out annually in the period between two QAL2 procedures. Apart from certain functional tests, the systematics is the same for CEMS and PEMS.

2 Prior to the parallel measurements it must be determined whether the measuring system is installed properly and operates normally. The results of the functional test must be documented. In case of deviations that can have an effect on the quality of the measurement data, the operator must undertake corrective and preventive actions. Recommendations as a result of deviations detected earlier must have been adopted or implemented. These recommendations can be found in the conclusions of the latest AST or QAL2 report.

3 During the AST, minimally five parallel measurements are performed with the measuring system and with the standard reference method for the component in question (SRM, see AST/5). The measurements must be distributed evenly over one working day.

4-7 See Quality-determining factors QAL2.

8 The dispersion of the values of the automated measuring system in relation to the calibration function is called the variability. The variability is tested against the uncertainty requirement as specified in the law and regulations. The AST also includes a test of the validity of the calibration function. The results of the AST measurements may be used to extend the valid calibration range. If one or both of the above-mentioned tests are negative, the causes must be identified and rectified. New parallel measurements in accordance with the QAL2 procedure must then be performed within six months.

More information	
QAL1 procedure	NEN-EN-ISO 14956
Quality assurance measurement body / laboratory	NEN-EN-ISO/IEC 17025 or 17020
NEN-EN 14181 Implementation within the framework of NO_x emissions trading; Background document, factsheets and calculation sheets	Website Netherlands Emission Authority (NEa)
Standard reference methods (SRM)	www.infomil.nl
Background information	InfoMil publication “Measurement of air emissions” (L40)

Checklist for quality assurance of automated measuring systems

When one of the questions in the checklists is answered negatively and no satisfactory reasons are given for the deviation, then corrective measures are necessary for obtaining a reliable measurement result.

	QAL1		yes	no	n/a
1a	**Report / sources and operating conditions**	Has QAL1 been demonstrably performed (report) and have the relevant uncertainty sources and associated operating conditions been identified and quantified?	☐	☐	☐
1b	**Test value**	Has QAL1 been performed at the correct test value?	☐	☐	☐
2	**Sampling**	Has the sampling been included as an uncertainty source?	☐	☐	☐
3	**Conversion**	Have the relevant conversion measurements (determination of temperature, pressure, moisture and/or oxygen content) been included as an uncertainty source?	☐	☐	☐
4	**Performance characteristics**	Do the values of the performance characteristics correspond with the manufacturer's specifications or other documentation?	☐	☐	☐
5	**Testing**	Does the total uncertainty of the measuring system meet the uncertainty requirement as specified in the law and regulations?	☐	☐	☐
6	**QAL3 criteria**	Are the criteria derived for the QAL3 procedure?	☐	☐	☐
7	**Response time – CEMS**	Is the response time of the measuring system smaller than 25% of the shortest time period over which an average concentration must be determined according to the law and regulations?	☐	☐	☐
	Response time – PEMS	Is the response time of the measuring instruments that provide the input data smaller than 25% of the shortest time period over which an average concentration must be determined according to the law and regulations?	☐	☐	☐

	QAL2		yes	no	n/a
1	**Report / frequency**	Has QAL2 been demonstrably performed (report) within the period specified by the law and regulations?	☐	☐	☐
2	**Functional tests**	Have the results of the functional tests been documented and have any corrective and preventive actions been carried out?	☐	☐	☐
3	**Parallel measurements**	Have minimally 15 parallel measurements been carried out evenly distributed over three working days within a maximum period of four weeks?	☐	☐	☐
4	**Measurement body**	Does the responsible measurement body meet the quality requirements specified by the law and regulations?	☐	☐	☐
5	**Standard reference method**	Has the standard reference method been applied (also for any conversion measurements) and have the measurements been performed in accordance with the measurement standard (see L40 factsheet Periodic measurement)?	☐	☐	☐
6	**Sampling**	Have the measurements with the SRM been performed by means of independent sampling?	☐	☐	☐
7a	**Simultaneity**	Do the measurement results of the measuring system and of the measurement with the SRM involve the same time interval (same start and end time)? Are the values of the automated measuring system recorded immediately?	☐	☐	☐
7b	**Time between measurements**	Does the time between two successive measurements meet the specified requirement?	☐	☐	☐
8a	**Calibration function – conversion**	Are the results of the automated measuring system and those of the measurements with the SRM expressed in the same units and converted to the same standard conditions?	☐	☐	☐
8b	**Calibration function – establishment**	Has a calibration function $y = a + bx$ been established on the basis of the parallel measurements?	☐	☐	☐
8c	**Calibration function – application**	Is the calibration function applied correctly in the determination of the emission concentrations?	☐	☐	☐
9	**Calibration range**	Has the valid calibration range been recorded?	☐	☐	☐
10	**Variability test**	Has the variability test been performed and does the measuring system meet the uncertainty requirement as specified in the law and regulations?	☐	☐	☐
11a	**Repetition of QAL2 – types of operation**	Does the company have clearly different types of operations and has a QAL2 been carried out for each of these types?	☐	☐	☐
11b	**Repetition of QAL2 – calibration range**	Has a new QAL2 been performed upon exceeding of the number of permissible measurement values outside the calibration range QAL2 (see QAL3/3)?	☐	☐	☐

Checklist for quality assurance of automated measuring systems cont.

When one of the questions in the checklists is answered negatively and no satisfactory reasons are given for the deviation, then corrective measures are necessary for obtaining a reliable measurement result.

	QAL3		yes	no	n/a
1a	**Periodic checks – CEMS**	Is the system checked periodically with a zero and a control gas and does the control gas have a valid analysis certificate?	☐	☐	☐
	Periodic checks – PEMS	Is the system checked periodically on the basis of a reference situation of the operating conditions (REFBO) or does a periodic check of the model input parameters (MIP) take place?	☐	☐	☐
1b	**Periodic checks – frequency**	Does the control frequency of the QAL3 correspond with the drift period in QAL1?	☐	☐	☐
2	**Control charts**	Are the results of the checks recorded with the aid of (CUSUM or Shewart) control charts?	☐	☐	☐
3	**Calibration range – check**	Does a check take place on how many measurement values fall outside the calibration range?	☐	☐	☐
3b	**Calibration range – action**	Has a new QAL2 been performed upon exceeding of the number of permissible values outside the calibration range (see QAL2/11c)?	☐	☐	☐

	AST		yes	no	n/a
1	**Report / frequency**	Has the AST been demonstrably performed (report) in the interim period between two QAL2 procedures?	☐	☐	☐
2	**Functional tests**	Have the results of the functional tests been documented and have any corrective and preventive actions been carried out? Have the recommendations of the previous AST or QAL2 been adopted and implemented?	☐	☐	☐
3	**Parallel measurements**	Have minimally five parallel measurements been performed evenly distributed over one working day?	☐	☐	☐
4	**Measurement body**	Does the responsible measurement body meet the quality requirements as specified in the law and regulations?	☐	☐	☐
5	**Standard reference method**	Has the standard reference method been applied (also for any conversion measurements) and have these measurements been performed in accordance with the measurement standard (see L40 factsheet Periodic measurement)?	☐	☐	☐
6	**Sampling**	Have the measurements been performed with the SRM by means of independent sampling?	☐	☐	☐
7a	**Simultaneity**	Do the measurement results of the measuring system and of the measurement with the SRM involve the same time interval (the same start and end time)? Are the values of the automated measuring system recorded immediately?	☐	☐	☐
7b	**Time between measurements**	Does the time between two successive measurements meet the specified requirement?	☐	☐	☐
8a	**Conversion**	Are the results of the automated measuring system and of the measurements with the SRM expressed in the same units and converted to the same standard conditions?	☐	☐	☐
8b	**Variability test and test on validity of the calibration function**	Has a) the variability test been performed and does the measuring system meet the uncertainty requirement as specified in the law and regulations and is b) the calibration function still valid?	☐	☐	☐

InfoMil, a link between environmental policy and implementation.
InfoMil is an initiative of the Ministry for the Environment and the Ministry of Economic Affairs in co-operation with the Association of Provinces (IPO), the Association of Dutch Municipalities (VNG) and the Union of Water Boards.

InfoMil
Juliana van Stolberglaan 3
2595 CA The Hague
PO Box 93144
2509 AC The Hague

Telephone +31 (0)70 373 55 75
Fax +31(0)70 373 56 00
E-mail info@infomil.nl
Website www.infomil.nl

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