Protocol Euramet QM-K3.2019

Automotive exhaust gases

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# Background

To support calibration and measurement capabilities (CMCs) for gas mixtures presenting little analytical challenge, a key comparison on a 'core' gas mixture is organised.

# Measurands

Amount fractions carbon monoxide, carbon dioxide, oxygen and propane (in a matrix of high-purity nitrogen)

# Mixtures

A set of mixtures will be prepared gravimetrically and subsequently verified against other PSMs. The mixtures will be prepared by the coordinating laboratory VSL, the Dutch Metrology Institute. The nominal composition of the mixtures is within the following ranges:

Table 1: Nominal ranges of amount of substance fractions

|  |  |
| --- | --- |
| Component | Amount fraction*X* |
| Carbon monoxide  | 0.5 % – 2 % |
| Carbon dioxide  | 2 % – 5 % |
| Oxygen | 1 % – 4 % |
| Propane | 100 ppm – 300 ppm |
| Nitrogen | Balance |

The pressure in the cylinders will be approximately 10 MPa; cylinders of 5 dm3 nominal volume will be used. The amount-of-substance fractions as calculated from gravimetry and purity data will be used as key comparison reference value. Each cylinder will have its own reference value and associated expanded uncertainty.

Please note that:

1. Participating laboratories are responsible for the calibration of their own equipment. For a proper evaluation of the data, it is necessary that the calibration method, as well as the way in which the calibration mixtures have been prepared is reported to the co-ordinator in sufficient detail to check the data for obvious omissions.
2. After the measurements, the participants have to return the cylinders with a sufficient amount of gas (pressure shall be at least 1.5 MPa) to VSL for re-analysis.
3. Transport of the cylinders to the participating laboratories and back to the coordinating laboratory (VSL) will be arranged and paid for by the participants. The participants are also responsible for returning the cylinders promptly after completing the measurements.
4. The measurement report requires per cylinder at least three independent measurements, obtained under repeatability conditions. This is a strict requirement to come to proper statistical analysis of the reported data.
5. Reporting of the results should be done using the Excel reporting form (Euramet.QM-K3.2019) accompanying this protocol.
6. Participating laboratories are requested to specify in detail which analytical method(s) have been used and how the evaluation of measurement uncertainty was performed.
7. Additional measurement reports and additional information can be submitted jointly with the report forms to VSL and will be taken into consideration during the evaluation.
8. Reports shall be submitted in the requested format, without making any changes to, e.g., the typeface (font) settings etc.
9. The measurement reports shall meet the standards that *Metrologia* applies for submitted papers. Furthermore, the following requirements are to be met:
* Equations shall be typeset in the equation editor of Word 2007 or later.
* Participating laboratories are to express the uncertainty on all results submitted, as expanded uncertainty. The evaluation of measurement uncertainty should be in accordance to the “Guide to the expression of uncertainty in measurement”. The participant should provide a detailed description of the uncertainty budget, including
	+ Correct vocabulary of the measurand and all input quantities
	+ All data necessary for reproducing the measurement results and final result recorded in the reporting forms
	+ All models used for calculating intermediate and final results; models taken verbatim from international standards (e.g., ISO 6142-1, ISO 6143) should be given by reference
	+ Evaluation method of standard uncertainty (type A or type B), including as appropriate the (assumed) probability distribution
1. Measurement reports not meeting these requirements will be rejected and returned to the laboratory for improvement.

# Supported claims

This key comparison can be used to support CMC claims for mixtures of propane in nitrogen, propane in air, and mixtures falling into the category of "core gas mixtures".

# Participants

Participants: VSL (NL), BAM (DE), CEM (ES), LNE (FR), BFKH (HU), GUM (PL), SMU (SK), METAS (SU), UME (TR), CMI(CZ)

# Schedule

The schedule for this key comparison reads as follows

Table 2: Key comparison schedule

|  |  |
| --- | --- |
| **Date** | **Event** |
| **October 2018** | Agreement of protocol  |
| **October 2018** | Registration of participants |
| **January/February 2021** | Re-verification of mixture compositions |
| **April 2021** | Dispatch of mixtures |
| **August 2021** | Reports and cylinders arrived back at VSL |
| **September 2021** | Re-verification of the mixtures |
| **December 2021** | Draft A report available |
| **March 2022** | Draft B report available |

Failing to meet the timetable may have consequences with respect to the participation in this key comparison.

# Coordinator

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# Measurement report

### Calibration standards

Please provide a brief description of the calibration standards used, including

* Method of preparation
* Weighing data
* Purity tables (composition) of the parent gases
* Verification measures

### Instrumentation

Please provide a brief description of the particulars of the instrument(s) used in this key comparison:

### Calibration method and value assignment

Please provide a brief description how the equipment was calibrated and how the assigned value was calculated (including the necessary formulae):

### Uncertainty evaluation

Please provide a brief description of the evaluation of measurement uncertainty, including the expressions used:

### References

Any literature references you may wish to refer to come here …

### Authorship

Please provide the authorship of the measurement report (2-3 persons typically)