EN 14181 together with
EN 15267
and it’s relevance for
industrial plant operators

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QAL1.de
QAL 1, EN 15267
Context and roots, Emission monitoring

• The first EU specifications on the quality of measurement results were published in

- 2000/76/EC waste incineration
- 2001/80/EC large combustion plants

Definition of ELV and Measurement Uncertainty

• Technical Description

- EN 14181 Quality assurance of automated measuring systems

→ Valid for all kind of plants which are regulated by EU!

• and for

→ 2003/87/EG „Emission trading for green house gases“
QAL 1, EN 15267
Enlargement and future application

The future application is defined in the 2010/75/EC

„Directive on industrial emissions (Integrated pollution prevention and control)“

Summary of the following directives:

- „Titandioxide-Production“ 78/176/EWG and 82/883/WG
- „IVU directive“ 96/61/EG
- „VOC directive“ 1999/13/EG
- „Incineration plant directive“ 2000/76/EG
- „Power plant directive“ 2001/80/EG
- „Emission trading“ 2003/87/EG
EN 14181
Objectives

**EN 14181 supports Requirements of:**

- **Directive 2000 / 76 / EC of 4 Dec 2000**  
  Incineration of Waste (WID)

  Large Combustion Plants (LCPD)

- **Directive 2010 / 75 / EC of 24 Nov 2010**  
  Industrial Emissions

and other National Legislation
Industrial Emission Directive

What is new:

- **Article 15:** Emission values (BAT Documents)
- **Article 21:** Reconsideration and updating of the permission by competent authority (in the first 4 years)
- **Article 22:** Side closure Status of the plant
- **Article 23:** Environmental Inspections
  - Environmental Inspection Plan
    - List of Plants, Organization, environmental risk
  - Environmental Inspection Program Time schedule
EN 14181
QA Procedures of AMS

Annex III of EC Directives:
Measurement Techniques
At the daily emission level value ELV, the values of the 95% confidence interval of a single measured result shall not exceed the following percentages of the ELV:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>10%</td>
</tr>
<tr>
<td>Sulphur and Nitrogen dioxide</td>
<td>20%</td>
</tr>
<tr>
<td>Total dust</td>
<td>30%</td>
</tr>
<tr>
<td>Total organic carbon</td>
<td>30%</td>
</tr>
<tr>
<td>Hydrogen chloride and fluoride</td>
<td>40%</td>
</tr>
</tbody>
</table>
EN 14181
QA Levels for Monitoring

Suitability of AMS
Set-up Calibration Validation
QA during Operation

QAL 1 → QAL 2
QAL 3
Annual Surveillance Test
Environmental Protection

EN 14181
Context with other Standards

EU Directives 2000/76/EC
2001/80/EC

EN 14181
QA AMS

QAL 1
ISO 14956
Type Approval and Certification EN 15267

QAL 2
SRM
EN xyz
Strategy
EN 15259

QAL 3
Records / Charts

AST
SRM
EN xyz
Strategy
EN 15259
EN 15267
Concept scheme of EN 14181:

- **Suitability of AMS**
  - QAL1

- **Initial setup of AMS**
  - Correct installation
  - AST
  - QAL2

- **AMS in operation**
  - AST
  - AST
  - QAL2
  - AST
  - Regular QA during operation QAL 3
  - 1 year
  - 1 year
  - 1 year
  - 3 to 5 years

- In parallel by operator
  - 4 weeks
  - 1 year
  - 3 months
  - 3 months

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QAL 1, EN 14181: Approved AMS

**QAL 1: Suitability of AMS**

Standard ISO 14956 specifies:
- Evaluation of the applicability of the method based on laboratory performance and confirmatory field test
- Requirements on dynamic behaviour of AMS
- EN 15627 specifies requirements and test procedures

To be performed by **Accredited Test Laboratory**

Scope of work:  
- Type Approval  
- Performance Evaluations  
- Uncertainty Calculations
EN 15267 in International Context
Scope

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement the European standard series EN 15267:

Austria
Cyprus
Estonia
Greece
Italy
Malta
Portugal
Spain
Belgium
Czech Republic
Finland
Hungary
Latvia
Netherlands
Romania
Sweden
Bulgaria
Denmark
France
Iceland
Lithuania
Norway
Slovakia
Sweden
EN 15267 in International Context
Status of implementation in Member States

- In some member states, the competent authority delegates responsibility to a certification body accredited to EN 45011 by national accreditation bodies.
- In some member states the competent authority cannot be accredited by external bodies – in others they may be.

⇒ EN 15267 uses the collective term “Relevant body” when referring to either competent authority or certification body.

in Germany: Competent Authority = UBA/LAI
in England: Certification Body = SIRA

EN 15267-1 and EN 15267-2 are in force since May 2010.
EN 15267-3 is in use since March 2008.
EN 15267 part 3
Minimum requirements and test procedures
Complete AMS

A complete AMS consists of:

- Heated or unheated probe, including necessary filters
- Heated or unheated line from the probe to the cooler / analyzer
- Pump
- e.g. cooler (if necessary)
- Analyzer
- Measurement output, status signals etc.
- Manuals
- special equipment for QAL 3 if required
- Reference Standards, without certified bottle gases
- Type approval report
- Letters, supplementary report etc. about changes to the instrument
QAL 2, EN 14181:
Set-up & Calibration & Validation

QAL 2: Installation and Functionality of AMS

- Quality assurance of installation
- Calibration using SRM
- Uncertainty calculations

To be performed by a Accredited Test Laboratory

Scope of work:
- Correct Installation
- Functionality Checks
- Calibration Function
- Variability & Uncertainty
- Data Validation
AMS for monitoring official limit values require a certification of suitability and the associated notification in the Federal Gazette. The following points shall be observed:

- Is the QAL1 test valid for that particular plant type?
- Is the certification range appropriate for the half-hour limit value to be monitored?
- Are additional measuring ranges for monitoring the daily limit value available?
- Is the AMS appropriate for the parameters of that particular plant?
QAL2 = Calibration of automated measuring systems

Relevant for Plant operators
   Accredited test house EN 17025

- Procedures for the first QAL2:
  - Confirmation of the installation
  - Functional test
  - Calibration of the AMS with standard reference methods (SRM)
  - Determination of the validity range of the calibration curve
  - Determination of the variability of the AMS and verification of compliance with the specified uncertainty
  - Reporting
Flow chart for calibration procedure and test for variability

Conversion to AMS measuring conditions

Conversion to standard conditions using SRM equipment

Selection of calibration procedure (a) or (b) in 6.4.2

Calculation of the calibration function

Test of variability

Eventually conversion between units (e.g. mA to mg/m³)

Calculation of calibrated values, using the calibration function

Conversion to standard conditions using plant equipment

Definition of valid calibration range

1. SRM
2. y₁
3. y₁S
4. x₁
5. Calculation of the calibration function
6. ŷ₁
7. ŷ₁S
8. [0 ; 1,1]
9. [yS,min ; yS,max]
10. [yS,min ; yS,max]
Functional test according to Annex A

- At least 15 valid paired measurements with a SRM.
  The following points shall be observed:
  - Distribution over a min. of 3 days within 4 weeks
  - Max. 1 measurement per hour
  - All operating modes of the plant shall be covered
  - Calibration period: 3 days
  - All parameters for normalisation shall be determined separately

Determination of variability and verification of compliance with the specified uncertainty
EN 14181 QAL2 – Frequency of performance

QAL2 shall be performed:

- At least every 5 years
- At shorter intervals, if stipulated by other legal requirements
- At shorter intervals, if indicated in the notification of approval

A calibration is also necessary, if:

- The values measured are frequently outside the range of validity of the calibration curve
- The operating conditions of the plant undergo significant changes
- Any changes or repairs which will affect the results obtained are made to the AMS or any of its parts
- The AMS did not pass the AST

A period of max. 6 months is specified for the execution and implementation of QAL2 (Process concluded by report of competent authorities).
QAL 3, EN 14181: Drift and Precision

**QAL 3:** QA during on-site Operation by Records / Control Charts

- Quality assurance of measuring data
  - Frequent zero and span checks of AMS

- Guarantee and documentation of AMS quality
  - Evaluation of results

To be performed by **Process Operator**

Scope of work:  
- Zero & Span Drift Control  
- Precision of AMS  
- Evident Documentation
QAL3 = ongoing quality assurance during operation

Concerned are: Plant operators or contractors commissioned to perform maintenance works

QAL3 is a procedure designed for maintaining and demonstrating the quality of the AMS results during ongoing operation.
The EN 14181 QAL3 procedure serves the purpose of ensuring and demonstrating the quality of the AMS through regular drift and precision checks.

Drift and precision controls shall be achieved by the use of control charts:

- Shewart control charts
- CUSUM control charts, manual evaluation is permitted in exceptional cases
AST, EN 14181:
Annual Surveillance Test

**AST:** Installation and Functionality of AMS

- Evaluation, if AMS is functioning correctly and performance remains valid
- Check if AMS’s calibration and variability remain as previously determined during QAL2

To be performed by a **Accredited Test Laboratory**

Scope of work:
- Functionality Checks
- Confirmation of Calibration Function (by 5 comparison measurements with SRM)
- Variability & Validity of calibration function
System integrator:
A system integrator is a supplier of measuring systems, who purchases analysers from other manufacturers and combines these with other bought-in parts and/or parts designed and manufactured by his own company in order to produce a complete system.

Problem:
According to Directive EN 15267, only a complete measuring system can undergo certification and not just the analyser.

- If a system integrator purchases an analyser which belongs to a previously suitability-tested complete system, this does not mean that the analyser in combination with the complete system of the system integrator is suitability-tested as well.
- Certificates associated to the original performance testing are not transferable to the measuring system of the system integrator.
Summary

Instrument manufacturer:

• Production and distribution of a measuring system that conforms with the technical conditions in which it was tested and certified (hardware/software).
• Compliance with the multi-step model of Directive 15267 part 2 regarding instrument design changes.

Plant operator:

• Use of suitability-tested measuring system for monitoring official limit values.
• A certification according to EN 15267 is only granted for complete systems (from the sampling device to the analogue output). Only the parts listed in the test report may be used at new installations, otherwise the suitability test may be deemed invalid!

Test institute:

• For AST and issuing of certificate of installation: Test of conformity of the measuring system with the technical conditions of the measuring system tested for suitability and described in the test report in accordance with the requirements of EN 15267.
Thank you for your attention