



SLOVENSKI STANDARD
kSIST-TS FprCEN/TS 17021:2016
01-september-2016

Emisije nepremičnih virov - Določevanje masne koncentracije žveplovega dioksida z instrumentalnimi tehnikami

Stationary source emissions - Determination of the mass concentration of sulphur dioxide by instrumental techniques

Emissionen aus stationären Quellen - Ermittlung der Massenkonzentration von Schwefeldioxid mit instrumentellen Verfahren

Émissions de sources fixes - Mesurage des émissions de dioxyde de soufre par des techniques instrumentales

Ta slovenski standard je istoveten z: FprCEN/TS 17021

ICS:

13.040.40 Emisije nepremičnih virov Stationary source emissions

kSIST-TS FprCEN/TS 17021:2016 en,fr,de

TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

FINAL DRAFT
FprCEN/TS 17021

June 2016

ICS 13.040.40

English Version

**Stationary source emissions - Determination of the mass
concentration of sulphur dioxide by instrumental
techniques**

Émissions de sources fixes - Détermination de la
concentration massique en dioxyde de soufre par des
techniques instrumentales

Emissionen aus stationären Quellen - Ermittlung der
Massenkonzentration von Schwefeldioxid mit
instrumentellen Verfahren

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 264.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a Technical Specification. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a Technical Specification.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Symbols and abbreviations	11
4.1 Symbols.....	11
4.2 Abbreviated terms.....	12
5 Principle	12
5.1 General.....	12
5.2 Measuring principle.....	13
6 Description of the measuring system	13
6.1 General.....	13
6.2 Sampling and sample gas conditioning system.....	14
6.3 Analyser equipment.....	16
7 Performance characteristics of the method	16
8 Suitability of the measuring system for the measurement task	18
9 Field operation	19
9.1 Measurement section and measurement plane.....	19
9.2 Sampling strategy.....	20
9.3 Choice of the measuring system.....	20
9.4 Setting of the measuring system on site.....	21
10 Ongoing quality control	23
10.1 Introduction.....	23
10.2 Frequency of checks.....	23
11 Expression of results	23
12 Measurement report	24
Annex A (informative) Example of uncertainty estimation for the method and compliance with required emissions measurement uncertainty	25
A.1 General.....	25
A.2 Elements required for the uncertainty determinations.....	25
A.3 Example uncertainty budget.....	28
A.4 Evaluation of compliance with a required measurement uncertainty.....	34
Annex B (informative) Calculation of the uncertainty associated with a concentration expressed under dry conditions and at an oxygen reference concentration	35
B.1 Uncertainty associated with a concentration expressed under dry conditions.....	35
B.2 Uncertainty associated with a concentration expressed at a O ₂ reference concentration.....	37

Annex C (normative) Annual lack of fit test	39
C.1 Description of test procedure	39
C.2 Establishment of the regression line.....	39
C.3 Calculation of the residuals.....	40
C.4 Test requirements.....	40
Annex D (informative) Annual check of conditioning system	41
D.1 General	41
D.2 Demonstration via proficiency testing scheme participation.....	41
D.3 Demonstration via direct user testing of conditioning system.....	41
Annex E (informative) Procedure for correction of data from drift effect.....	43
Annex F (informative) Chemistry of SO₂ aqueous solubility	44
Bibliography	45

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST-TS CEN/TS 17021:2017](https://standards.iteh.ai/catalog/standards/sist/4e2111b9-3cc4-46ce-b9de-b40f9ab9dba8/sist-ts-cen-ts-17021-2017)

<https://standards.iteh.ai/catalog/standards/sist/4e2111b9-3cc4-46ce-b9de-b40f9ab9dba8/sist-ts-cen-ts-17021-2017>

FprCEN/TS 17021:2016 (E)

European foreword

This document (FprCEN/TS 17021:2016) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This document is currently submitted to the vote.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST-TS CEN/TS 17021:2017](https://standards.iteh.ai/catalog/standards/sist/4e2111b9-3cc4-46ce-b9de-b40f9ab9dba8/sist-ts-cen-ts-17021-2017)

<https://standards.iteh.ai/catalog/standards/sist/4e2111b9-3cc4-46ce-b9de-b40f9ab9dba8/sist-ts-cen-ts-17021-2017>

1 Scope

This Technical Specification describes a method for sampling and determining the concentration of gaseous sulphur dioxide (SO₂) emissions from stacks. This method is based on instrumental techniques. It is applicable to both periodic measurements and the calibration of automated measuring systems permanently installed on stacks, for regulatory or other purposes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15259:2007, *Air quality - Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report*

FprEN 14793:2016, *Stationary source emission - Demonstration of equivalence of an alternative method with a reference method*

FprEN 15267-4, *Air quality - Certification of automated measuring systems - Part 4: Performance criteria and test procedures for automated measuring systems for periodic measurements of emissions from stationary sources*

EN ISO 14956:2002, *Air quality - Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty (ISO 14956:2002)*

ISO/IEC Guide 98-3, *Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

standard reference method

SRM

reference method prescribed by European or national legislation

[SOURCE: EN 15259:2007]

3.2

reference method

RM

measurement method taken as a reference by convention, which gives the accepted reference value of the measurand

NOTE 1 A reference method is fully described.

NOTE 2 A reference method can be a manual or an automated method.

NOTE 3 Alternative methods can be used if equivalence to the reference method has been demonstrated.

[SOURCE: EN 15259:2007]

FprCEN/TS 17021:2016 (E)**3.3
alternative method
AM**

measurement method which complies with the criteria given by this European Standard with respect to the reference method

Note 1 to entry: An alternative method can consist of a simplification of the reference method.

[SOURCE: FprEN 14793:2016]

**3.4
measuring system**

set of one or more measuring instruments and often other devices, including any reagent and supply, assembled and adapted to give information used to generate measured quantity values within specified intervals for quantities of specified kinds

[SOURCE: JCGM 200:2012]

**3.5
automated measuring system
AMS**

entirety of all measuring instruments and additional devices for obtaining a result of measurement

Note 1 to entry: Apart from the actual measuring device (the analyser), an AMS includes facilities for taking samples (e.g. probe, sample gas lines, flow meters and regulator, delivery pump) and for sample conditioning (e.g. dust filter, pre-separator for interferences, cooler, converter). This definition also includes testing and adjusting devices that are required for functional checks and, if applicable, for commissioning.

Note 2 to entry: The term “automated measuring system” (AMS) is typically used in Europe. The term “continuous emission monitoring system” (CEMS) is also typically used in the UK and USA.

[SOURCE: FprEN 15267-4:2016]

**3.6
portable automated measuring system
P-AMS**

automated measuring system which is in a condition or application to be moved from one to another measurement site to obtain measurement results for a short measurement period

Note 1 to entry: The measurement period is typically 8 h for a day.

Note 2 to entry: The P-AMS can be configured at the measurement site for the special application but can be also set-up in a van or mobile container. The probe and the sample gas lines are installed often just before the measurement task is started.

[SOURCE: FprEN 15267-4:2016]

3.7**calibration**

set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring method or measuring system, and the corresponding values given by the applicable reference

Note 1 to entry: In case of automated measuring system (AMS) permanently installed on a stack the applicable reference is the standard reference method (SRM) used to establish the calibration function of the AMS.

Note 2 to entry: Calibration should not be confused with adjustment of a measuring system.

[SOURCE: FprEN 15058:2016]

3.8**adjustment**

set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

Note 1 to entry: The adjustment can be made directly on the instrument or using a suitable calculation procedure.

[SOURCE: FprEN 15058:2016]

3.9**span gas**

test gas used to adjust and check a specific point on the response line of the measuring system

Note 1 to entry: This concentration is often chosen around 80 % of the upper limit of the range

3.10**measurand**

particular quantity subject to measurement

[SOURCE: EN 15259:2007]

Note 1 to entry: The measurand is a quantifiable property of the stack gas under test, for example mass concentration of a measured component, temperature, velocity, mass flow, oxygen content and water vapour content.

3.11**interference**

negative or positive effect upon the response of the measuring system, due to a component of the sample that is not the measurand

3.12**influence quantity**

quantity that is not the measurand but that affects the result of the measurement

Note 1 to entry: Influence quantities are e.g. presence of interfering gases, ambient temperature, pressure of the gas sample.

3.13**ambient temperature**

temperature of the air around the measuring system

FprCEN/TS 17021:2016 (E)**3.14****emission limit value****ELV**

limit value given in regulations such as EU Directives, ordinances, administrative regulations, permits, licences, authorizations or consents

Note 1 to entry: ELV can be stated as concentration limits expressed as half-hourly, hourly and daily averaged values, or mass flow limits expressed as hourly, daily, weekly, monthly or annually aggregated values.

3.15**measurement site**

place on the waste gas duct in the area of the measurement plane(s) consisting of structures and technical equipment, for example working platforms, measurement ports, energy supply

Note 1 to entry: Measurement site is also known as sampling site.

[SOURCE: EN 15259:2007]

3.16**measurement plane**

plane normal to the centreline of the duct at the sampling position

Note 1 to entry: Measurement plane is also known as sampling plane.

[SOURCE: EN 15259:2007]

3.17**measurement port**

opening in the waste gas duct along the measurement line, through which access to the waste gas is gained

Note 1 to entry: Measurement port is also known as sampling port or access port.

[SOURCE: EN 15259:2007]

3.18**measurement line**

line in the measurement plane along which the measurement points are located, bounded by the inner duct wall

Note 1 to entry: Measurement line is also known as sampling line.

[SOURCE: EN 15259:2007]

3.19**measurement point**

position in the measurement plane at which the sample stream is extracted or the measurement data are obtained directly

Note 1 to entry: Measurement point is also known as sampling point.

[SOURCE: EN 15259:2007]

3.20**performance characteristic**

one of the quantities (described by values, tolerances, range) assigned to equipment in order to define its performance

3.21**response time**

duration between the instant when an input quantity value of a measuring instrument or measuring system is subjected to an abrupt change between two specified constant quantity values and the instant when a corresponding indication settles within specified limits around its final steady value

Note 1 to entry: By convention time taken for the output signal to pass from 0 % to 90 % of the final variation of indication.

3.22**short-term zero drift**

difference between two zero readings at the beginning and at the end of the measurement period

3.23**short-term span drift**

difference between two span readings at the beginning and at the end of the measurement period

3.24**lack of fit**

systematic deviation within the range of application between the measurement result obtained by applying the calibration function to the observed response of the measuring system measuring test gases and the corresponding accepted value of such test gases

Note 1 to entry: Lack of fit can be a function of the measurement result.

Note 2 to entry: The expression "lack of fit" is often replaced in everyday language by "linearity" or "deviation from linearity".

3.25**repeatability in the laboratory**

closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

Note 1 to entry: Repeatability conditions include:

- same measurement method;
- same laboratory;
- same measuring system, used under the same conditions;
- same location;
- repetition over a short period of time.

Note 2 to entry: Repeatability can be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this European Standard the repeatability is expressed as a value with a level of confidence of 95 %.

FprCEN/TS 17021:2016 (E)**3.26****repeatability in the field**

closeness of the agreement between the results of simultaneous measurements of the same measurand carried out with two sets of equipment under the same conditions of measurement

Note 1 to entry: These conditions include:

- same measurement method;
- two sets of equipment, the performances of which are fulfilling the requirements of the measurement method, used under the same conditions;
- same location;
- implemented by the same laboratory;
- typically calculated on short periods of time in order to avoid the effect of changes of influence parameters (e.g. 30 min).

Note 2 to entry: Repeatability can be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this European Standard, the repeatability under field conditions is expressed as a value with a level of confidence of 95 %.

3.27**reproducibility in the field**

closeness of the agreement between the results of simultaneous measurements of the same measurand carried out with several sets of equipment under the same conditions of measurement

Note 1 to entry: These conditions are called field reproducibility conditions and include:

- same measurement method;
- several sets of equipment, the performances of which are fulfilling the requirements of the measurement method, used under the same conditions;
- same location;
- implemented by several laboratories.

Note 2 to entry: Reproducibility can be expressed quantitatively in terms of the dispersion characteristics of the results.

Note 3 to entry: In this European Standard, the reproducibility under field conditions is expressed as a value with a level of confidence of 95 %.

3.28**residence time in the measuring system**

time period for the sampled gas to be transported from the inlet of the probe to the inlet of the measurement cell

3.29**uncertainty**

parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand

3.30 standard uncertainty

u

uncertainty of the result of a measurement expressed as a standard deviation

3.31 combined uncertainty

u_c

standard uncertainty attached to the measurement result calculated by combination of several standard uncertainties according to the principles laid down in ISO/IEC Guide 98-3 (GUM)

3.32 expanded uncertainty

U

quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

$$U = k \times u$$

Note 1 to entry: In this European Technical Specification, the expanded uncertainty is calculated with a level of confidence of 95 %.

Note 2 to entry: The expression overall uncertainty is sometimes used to express the expanded uncertainty.

3.33 uncertainty budget

calculation table combining all the sources of uncertainty according to EN ISO 14956 or ISO/IEC Guide 98-3 in order to calculate the combined uncertainty of the method at a specified value

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the following symbols apply.

$A(t_0)$	(result given by the analyser after adjustment at t_0 at span point – result given by the analyser after adjustment at t_0 at zero point) / (calibration gas concentration at span point – calibration gas concentration at zero point)
$B(t_0)$	result given by the analyser after adjustment at t_0 at zero point
C	measured concentration
C_{corr}	measured concentration corrected for drift
Drift(A)	{[(result given by the analyser during the drift check at t_{end} at span point – result given by the analyser during the drift check at t_{end} at zero point) / (calibration gas concentration at span point – calibration gas concentration at zero point)] – $A(t_0)$ } / ($t_{\text{end}} - t_0$)
Drift(B)	(result given by the analyser during the drift check at t_{end} at zero point – result given by the analyser after adjustment at t_0 at zero point) / ($t_{\text{end}} - t_0$)