SLOVENSKI STANDARD
SIST EN 13725:2003

01-november-2003

Kakovost zraka – Ugotavljanje koncentracije vonja z dinamično olfaktometrijo

Air quality - Determination of odour concentration by dynamic olfactometry

Luftbeschaffenheit - Bestimmung der Geruchsstoffkonzentration mit dynamischer Olfaktometrie

Qualité de l'air - Détermination de la concentration d'une odeur par olfactométrie dynamique

Ta slovenski standard je istoveten z: EN 13725:2003

ICS:

13.040.01 Kakovost zraka na splošno Air quality in general

SIST EN 13725:2003 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13725

April 2003

ICS 13.040.99

English version

Air quality - Determination of odour concentration by dynamic olfactometry

Qualité de l'air - Détermination de la concentration d'une odeur par olfactométrie dynamique

Luftbeschaffenheit - Bestimmung der Geruchsstoffkonzentration mit dynamischer Olfaktometrie

This European Standard was approved by CEN on 6 December 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 13725:2003 E

Contents

Foreword

This document (EN 13725:2003) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

Annex A is normative. Annexes B, C, D, E, F, G, H, I and J are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard and its quality criteria were validated in an Interlaboratory Comparison for Olfactometry (ICO) in 1996, that was funded by the participating laboratories.

Sampling aspects are included in the structure of this Standard, although further research is necessary to complete this issue. Due to lack of financial support, no progress has been made on this point. Improvements in sampling may be the subject of a future revision of this European Standard.

1 Scope

This European Standard specifies a method for the objective determination of the odour concentration of a gaseous sample using dynamic olfactometry with human assessors and the emission rate of odours emanating from point sources, area sources with outward flow and area sources without outward flow. The primary application is to provide a common basis for evaluation of odour emissions in the member states of the European Union.

This European Standard is applicable to the measurement of odour concentration of pure substances, defined mixtures and undefined mixtures of gaseous odorants in air or nitrogen, using dynamic olfactometry with a panel of human assessors being the sensor. The unit of measurement is the European odour unit per cubic metre: ou_E/m^3. The odour concentration is measured by determining the dilution factor required to reach the detection threshold. The odour concentration at the detection threshold is by definition 1 ou_E/m^3. The odour concentration is then expressed in terms of multiples of the detection threshold. The range of measurement is typically from 10^1 ou_E/m^3 to 10^7 ou_E/m^3 (including pre-dilution).

The field of application of this European Standard includes:

— the measurement of the mass concentration at the detection threshold of pure odorous substances in g/m^3;

— the measurement of the odour concentration of mixtures of odorants in ou_E/m^3;

— the measurement of the emission rate of odorous emissions from point sources and surface sources (with and without an outward flow), including pre-dilution during sampling;

— the sampling of odorants from emissions of high humidity and temperature (up to 200 °C);

— the determination of effectiveness of end-of-pipe devices used to reduce odour emissions.

The characterisation of odour emissions requires detailed measurement of the gas velocity, that shall be performed according to the relevant standards included in the normative references.

This European Standard is not applicable to:

— the measurement of odours potentially released by particles of odorous solids or droplets of odorous fluids suspended in emissions;

— the measuring strategy to be applied in case of variable emission rates;

— the measurement of the relationship between odour stimulus and assessor response above detection threshold;

— direct measurement of hedonic tone (or (un)pleasantness) or direct assessment of potential annoyance;

— field panel methods;

— measurement of recognition thresholds;

— measurement of identification thresholds.

Although the ultimate application of odour measurement is in reducing odour nuisance, the relation between measured thresholds of odour according to this standard and the occurrence of odour nuisance is highly complex. It is profoundly influenced by the atmospheric processes determining the dispersion of odours, the quality of the odour (hedonic tone) and finally by the receptor characteristics of those exposed to the odour. These characteristics not only vary strongly between individuals, but also in time within one individual. The relation between emissions, dispersion, exposure and annoyance is not within the scope of this European Standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ISO 10780, *Stationary source emissions - Measurement of velocity and volume flowrate of gas streams in ducts.*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
accepted reference value
value that serves as an agreed upon reference for comparison, and which is derived as a consensus or certified value, based on collaborative experimental work under the auspices of a scientific or engineering group (derived from ISO 5725-1)

3.1.2
accuracy
closeness of agreement between test result and the accepted reference value

[ISO 5725-1]

NOTE The term ‘accuracy’, when applied to a set of test results, involves a combination of random components and a common systematic error or bias component.

3.1.3
(sensory) adaptation
temporary modification of the sensitivity of a sense organ due to continued and/or repeated stimulation

[ISO 5492]

3.1.4
anosmia
lack of sensitivity to olfactory stimuli

[ISO 5492]

3.1.5
assessor
somebody who participates in odour testing

3.1.6
bias
difference between the expectation of the test results and an accepted reference value

[ISO 5725-1]

NOTE Bias is often called 'systematic error'.

3.1.7
certified reference material, CRM
reference material of which one or more property values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation which is issued by a certifying body

[ISO 5725-4]

3.1.8
decision limit
output signal value above which it can be affirmed, with a probability of 1 - α of at least 95 %, that the measured sample is different from a zero sample

NOTE A zero sample has 5 % probability of causing an output signal above the decision limit (derived from ISO 6879).

3.1.9
delayed olfactometry
measurement of an odour with a time-lag between sampling and measurement. The odour sample is preserved in an appropriate container

3.1.10
detection threshold (for a reference material**)**
odorant concentration which has a probability of 0,5 of being detected under the conditions of the test

3.1.11
detection threshold (for an environmental sample**)**
dilution factor at which the sample has a probability of 0,5 of being detected under the conditions of the test

3.1.12
diffuse sources
sources with defined dimensions (mostly surface sources) which do not have a defined waste air flow, such as waste dumps, lagoons, fields after manure spreading, un-aerated compost piles

3.1.13
dilution factor
dilution factor is the ratio between flow or volume after dilution and the flow or volume of the odorous gas

3.1.14
dilution series
presentation of a sequence of dilutions to one panel member in order to obtain one Individual Threshold Estimate (see Figure 1)

NOTE One dilution series can consist of:
One series of presentations, at odour concentrations in ascending or random order, where, when sorted in order of descending concentrations, a significant change from consistently TRUE responses to a FALSE response occurs (see also Figure 1).

3.1.15
direct olfactometry
measurement of odour concentrations without any time-lag between the sampling (operation) and the measurements; equivalent to dynamic sampling or on-line olfactometry

3.1.16
dynamic olfactometer
dynamic olfactometer delivers a flow of mixtures of odorous and neutral gas with known dilution factors in a common outlet

3.1.17
dynamic olfactometry
olfactometry using a dynamic olfactometer

3.1.18
dynamic dilution
dilution achieved by mixing two known flows of gas, odorous sample and neutral gas, respectively. The rate of dilution is calculated from the flow rates

3.1.19
European Odour unit
that amount of odorant(s) that, when evaporated into 1 cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in one cubic metre of neutral gas at standard conditions

3.1.20
European Reference Odour Mass , EROM
accepted reference value for the European odour unit, equal to a defined mass of a certified reference material. One EROM is equivalent to 123 µg n-butanol (CAS-Nr. 71-36-3). Evaporated in 1 cubic metre of neutral gas this produces a concentration of 0,040 µmol/mol

3.1.21
expanded uncertainty
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

[ENV 13005]

3.1.22
expected value
value approached by the average value with an increasing number of measurement values

3.1.23
forced choice method
for this standard the following definition applies: An olfactometric method in which assessors are forced to make a choice out of two or more air flows, one of which is the diluted sample, even if no difference is observed

3.1.24
fugitive sources
elusive or difficult to identify sources releasing undefined quantities of odorants e.g. valve and flange leakage, passive ventilation apertures etc.

3.1.25
geometric mean
antilog of the arithmetic average of the logarithms of a set of values or $\sqrt[n]{y_1 \cdot y_2 \cdot \ldots \cdot y_n}$

NOTE The formula contains an *n*-root (not to be confused with a square root).

3.1.26
group threshold
detection threshold applying to a group of assessors

3.1.27
identification threshold
see recognition threshold

3.1.28
individual threshold
detection threshold applying to an individual

3.1.29
individual threshold estimate, ITE
detection threshold applying to an individual estimated on the basis of one dilution series

3.1.30
instability
change of a characteristic over a stated period of time, consisting of a systematic part (drift) and a random part (dispersion)

[ISO 9169]

3.1.31
instrumental dilution range
range between the minimum and maximum dilution factor

3.1.32
instrumental lag time
time taken for the output signal to reach 10 % (by convention) of the final change in reading (derived from ISO 6879)

3.1.33
instrumental response time
time taken for an instrument to respond to an abrupt change in value of the air quality characteristic. It is the sum of the lag time and rise time (rising mode) or lag time and fall time (falling mode) (derived from ISO 6879)

3.1.34
instrumental rise time (fall time)
time taken for the reading to pass from (by convention) 10 % to (by convention) 90 % of the final change in output signal reading (derived from ISO 6879). For instruments where transient oscillations occur in the approach to the final output signal reading, the rise time is the time taken for the instrument reading to pass from (by convention) 10 % of the final change in instrument reading until the oscillations fall to less than (by convention) 10 % of the final change in instrument reading

3.1.35
maximum dilution factor
maximum settable dilution factor of the olfactometer; an instrument property

3.1.36
measurement
the presentation to all panel members of those dilution series necessary to produce sufficient data to calculate the odour concentration for one sample (see Figure 1)

3.1.37
measuring range
measuring range comprises all odour concentrations which can be measured by a specific olfactometer. It depends on the minimum and maximum dilution factor and the step factor. The numerical values defining the measuring range are the minimum dilution factor multiplied with the step factor to the power 1,5 and the maximum dilution factor divided by the step factor to the power 1,5

3.1.38
minimum dilution factor
minimum settable dilution factor of the olfactometer; an instrument property

3.1.39
neutral gas
air or nitrogen that is treated in such a way that it is as odourless as technically possible and that does, according to panel members, not interfere with the odour under investigation

SAFETY WARNING Nitrogen is only used to predilute the sample itself. For the olfactometer the neutral gas used to dilute the sample and present a reference shall be air.

3.1.40
objective method
any method in which the effects of personal opinions are minimised

[ISO 5492]

3.1.41
odorant
substance which stimulates a human olfactory system so that an odour is perceived (Hangartner, M, 1989, see Bibliography)

3.1.42
odour flow rate
odour flow rate is the quantity of European odour units which crosses a given surface divided by time. It is the product of the odour concentration c_{od}, the outlet velocity v and the outlet area A or the product of the odour concentration c_{od} and the pertinent volume flow rate $\dot{V}$. Its unit is ou_E/h (or ou_E/min or ou_E/s, respectively)

NOTE The odour (emission) flow rate, expressed in units ou_E/s, is the quantity equivalent to the emission mass flow rate, expressed in kg/s, as used in dispersion models for example.

3.1.43
odorous gas
gas that contains odorants

3.1.44
odour
organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances

[ISO 5492]

3.1.45
odour abatement efficiency
reduction of the odour concentration or the odour flow rate due to an abatement technique, expressed as a fraction (or percentage) of the odour concentration in or the odour flow rate of the untreated gas stream

3.1.46
odour concentration
number of European odour units in a cubic metre of gas at standard conditions

NOTE The odour concentration is not a linear measure for the intensity of an odour. Steven's Law describes the a-linear relation between odour stimulus and its perceived intensity. When using odour concentrations in dispersion modelling, the issue is complicated by the effects of the averaging time of the dispersion model, further complicating the use of the odour concentration as a direct measure for dose. To define a 'no nuisance level', the entire method of dosage evaluation, including the dispersion model, will yield a 'dose'. The relation between this 'dose' and its effect (odour annoyance) should be validated in practical situations to be a useful predictive tool for occurrence of odour nuisance.

3.1.47
odour detection
to become aware of the sensation resulting from adequate stimulation of the olfactory system

3.1.48
odour panel
see panel

3.1.49
odour unit
one odour unit is the amount of (a mixture of) odorants present in one cubic metre of odorous gas (under standard conditions) at the panel threshold

NOTE See also "European odour unit".

3.1.50
odour threshold
see panel threshold

3.1.51
odourless gas
see neutral gas

3.1.52
olfactometer
apparatus in which a sample of odorous gas is diluted with neutral gas in a defined ratio and presented to assessors

3.1.53
olfactometry
measurement of the response of assessors to olfactory stimuli

[ISO 5492]

3.1.54
olfactory
pertaining to the sense of smell

[ISO 5492]

3.1.55
olfactory receptor
specific part of the olfactory system which responds to an odorant (derived from ISO 5492)

3.1.56
olfactory stimulus
that which can excite an olfactory receptor (derived from ISO 5492)

3.1.57
on-line olfactometry
see direct olfactometry

3.1.58
operator
person directly involved in operating the olfactometer and instructing the panel in olfactometry

3.1.59
panel
group of panel members

3.1.60
panel member
assessor who is qualified to judge samples of odorous gas, using dynamic olfactometry within the scope of this standard

3.1.61
panel screening
procedure to determine if the performance of panel members is in compliance with selection criteria. See also panel selection

3.1.62
panel selection
procedure to determine which assessors are qualified as panel members

3.1.63
panel threshold
detection threshold applying to a panel

3.1.64
perception
awareness of the effects of single or multiple sensory stimuli

[ISO 5492]

3.1.65
performance testing
determination of laboratory testing performance on reference materials against specified quality criteria

3.1.66
point source
discrete stationary source of emission of waste gases to atmosphere through canalised ducts of defined dimension and air flow rate (e.g. chimneys, vents)

3.1.67
population (detection) threshold
detection threshold applying to the general population, if this population is not specified

3.1.68
precision
closeness of agreement between independent test results obtained under prescribed conditions

[ISO 5725-1]

NOTE Precision depends only on the distribution of random errors and does not relate to the true value or the accepted reference value. The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Higher imprecision is reflected by a larger standard deviation. ‘Independent test results’ means results obtained in a manner not influenced by any previous result on the same or similar material.

3.1.69
presentation
one presentation is the presentation of one dilution to one assessor (see Figure 1)

3.1.70
presentation series
presentation of one dilution to all panel members in one round (see Figure 1)

3.1.71
presented gas flow
gas flow presented to the assessor. It may be:

— a diluted odour sample;

— neutral gas (e.g. as a blank or reference air)

3.1.72
proficiency testing
determination of laboratory testing performance by means of interlaboratory comparisons

[EN 45020]

3.1.73
quality
totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs

[ISO 6879]

3.1.74
quality assurance
all those planned and systematic actions necessary to provide adequate confidence that a product, process or service will satisfy given requirements for quality

[ISO 6879]

3.1.75
random error
unpredictable errors which average to zero

[ISO 5492]

3.1.76
recognition threshold
odour concentration which has a probability of 0,5 of being recognised under the conditions of the test (definition not applied in this standard)

3.1.77
reference material
substance or mixture of substances, the composition of which is known within specified limits, and one or more of the properties of which is sufficiently well established to be used for the calibration of an apparatus, the assessment of a measuring method, or for assigning values to materials (derived from ISO 6879)

3.1.78
reference value
see accepted reference value

3.1.79
repeatability
precision under repeatability conditions

[ISO 5725-1]

3.1.80
repeatability conditions
conditions where independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time

[ISO 5725-1]

3.1.81
repeatability limit
value less than or equal to which the absolute difference between two test results obtained under repeatability conditions may be expected to be with a probability of 0,95 (derived from ISO 5725-1)

3.1.82
reproducibility
precision under reproducibility conditions

[ISO 5725-1]

3.1.83
reproducibility conditions
conditions where test results are obtained with the same method on identical test material in different laboratories with different operators using different equipment

[ISO 5725-1]

3.1.84
reproducibility limit
value less than or equal to which absolute difference between two test results obtained under reproducibility conditions may be expected to be with a probability of 0,95 (derived from ISO 5725-1)

3.1.85
responsible person
person, who is ultimately responsible for the total of olfactometry in a laboratory

3.1.86
round
one round is the presentation of one dilution series to all assessors

3.1.87
sample
in the context of this standard, the sample is the odorous gas sample. It is an amount of gas which is assumed to be representative of the gas mass or gas flow under investigation, and which is examined for odour concentration
[ISO 6879]

3.1.88
sensory fatigue
form of adaptation in which a decrease in sensitivity occurs

[ISO 5492]

3.1.89
sensory reference
presented gas flow to which the diluted sample is compared

3.1.90
single measurement
identical to Measurement, see also test result

3.1.91
to smell
to detect or to attempt to detect an odorant

3.1.92
standard conditions for olfactometry
at room temperature (293 K), normal atmospheric pressure (101,3 kPa) on a wet basis (derived from ISO 10780)

NOTE This applies both to olfactometric measurements and volume flow rates of emissions. The conditions were chosen by convention, to reflect typical conditions for smell perception.