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Natural gas — Olfactory method for the evaluation of odour intensity

Gaz naturel — Méthode olfactive d'évaluation de l'intensité de l'odeur

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Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
3.1 General terms.....	1
3.2 Specific definitions for the gas odorants.....	2
4 Principle.....	3
5 Odour intensity scale.....	3
6 Apparatus.....	3
6.1 General.....	3
6.2 Test room.....	3
6.3 Dynamic olfactometer.....	3
6.4 Sample bag.....	4
7 Panel selection.....	4
8 Sampling.....	4
9 Safety precautions.....	4
10 Environmental conditions.....	4
11 Panel calibration: training and examination.....	4
12 Stimulus presentation.....	5
13 Time between two presentations.....	5
14 Expression of the results.....	6
15 Precision of the method.....	6
16 Uncertainty of the method.....	7
16.1 Calculation of uncertainty.....	7
16.2 Uncertainty of the odour intensity corresponding to a stated concentration.....	7
16.3 Uncertainty of the concentration corresponding to a stated odour intensity.....	8
16.4 Numerical example of uncertainty calculations.....	9
17 Test report.....	10
Bibliography.....	11

Foreword

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This document was prepared by Technical Committee ISO/TC 193, *Natural gas*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The odour intensity of an odorant in air is generally determined by human sense of smell. The odour intensity of odorants in air is determined by a group of specially trained persons who indicate in olfactory degrees the amount of the sensorial perception.

To provide a common reference for the odour intensity determination, a procedure of training using the specified odorant concentrations is described in this document.

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Natural gas — Olfactory method for the evaluation of odour intensity

1 Scope

This document describes how to establish the correlation between odorant concentration in air and odour intensity, usually presented in the form of odour intensity curves, following the odour intensity scale presented in [Clause 5](#).

This document does not fix a required level of odour intensity in the natural gas: this prescription is specified by local/national regulation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5492:2008, *Sensory analysis — Vocabulary*

ISO 14532:2014, *Natural gas — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5492, ISO 14532 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 General terms

3.1.1

odour intensity

strength of *odour perception* ([3.1.2](#))

Note 1 to entry: According to the general law established by Weber, Fechner and Stevens, the odour intensity is proportional to the logarithm of the odorant concentration.

Note 2 to entry: Expressed in this document as olfactory degree (see [Table 1](#)).

3.1.2

odour perception

awareness of the effect of volatile substances by the olfactory organ

[SOURCE: ISO 14532:2014, 2.8.3]

3.1.3

sensory fatigue

form of sensory adaption in which a decrease in sensitivity occurs

[SOURCE: ISO 5492:2008, 2.7]

3.1.4

terminal threshold

saturation threshold

minimum value of an intense sensory stimulus above which no difference in intensity can be perceived

[SOURCE: ISO 5492:2008, 2.28, modified — The term saturation threshold has been added and the Note 1 to entry has been deleted.]

3.2 Specific definitions for the gas odorants

3.2.1

panel of smellers

group of persons (smellers) trained to recognize odour intensities

Note 1 to entry: In this document, the term “panel” is used instead of “panel of smellers”.

3.2.2

detection threshold

odorant concentration at which 50 % of the population detects with a probability of 0,5 under test condition

Note 1 to entry: To detect an odour does not imply that this odour can be identified.

Note 2 to entry: See Reference [17].

[SOURCE: ISO 14532:2014, 2.8.9]

3.2.3

certainty threshold

odorant concentration at which 99 % of the population detects with a probability of 0,99 under test condition

Note 1 to entry: See Reference [17].

3.2.4

odour intensity curve

relationship of *odour intensity* (3.1.1) versus odorant concentration in air

Note 1 to entry: The odour intensity of an odorant for natural gas or a gas can only be determined by human olfactory organ.

3.2.5

olfactory judgement

judgement of a single smeller during an olfactometric evaluation at a specific odorant concentration

3.2.6

olfactory test

collection of the *olfactory judgements* (3.2.5) of the different smellers during an olfactometric evaluation at a specific odorant concentration

3.2.7

olfactory evaluation

collection of the *olfactory tests* (3.2.6) performed by the different smellers at different concentrations of odorant in air

Note 1 to entry: The results of the olfactory evaluation can be expressed by means of an *odour intensity* (3.1.1) curve.

4 Principle

The odour intensity of an odorant in air is judged by a panel of at least four smellers at different odorant concentrations in reference to the odour intensity scale presented in [Clause 5](#). The judgments of the panel members are collected and reported versus the odorant concentration on a logarithmic diagram. The panel members are trained and periodically tested.

5 Odour intensity scale

When tests are performed in reference to document, the following odour intensity scale shall be used by trained testers.

Table 1 — Odour intensity scale

Odour intensity (olfactory degrees)	Definition
0	No odour
1	Detection threshold
2	
3	Certainty threshold
4	
5	
6	
7	
8	
9	
10	Terminal threshold

The resolution for every member of the panel during an olfactory judgement is equal to 1 olfactory degree.

6 Apparatus

6.1 General

The presentation of the stimulus may be done with different apparatus. Hereafter some examples are described.

6.2 Test room

This is a chamber in which a stated concentration of odorant in air is obtained. The volume shall be known and the surface of the walls, ceiling and floor shall be covered by a material that cannot absorb/release odours. It shall be equipped with fans for homogenization of the fluid to be tested and an aspirator to purify the internal atmosphere between different tests. There shall be an apparatus to inlet and to measure the amount of gas containing the odorant from outside and/or a hot plate to evaporate the odorant inside the room. All the equipment shall fulfil all the applying safety requirements.

6.3 Dynamic olfactometer

Equipment that can produce the desired concentrations of odorant in air in a dynamic way. It shall be used in an environment with no appreciable odour. The equipment shall fulfil all the applying safety requirements.

6.4 Sample bag

Plastic bag in which it is possible to create known concentration of odorant in air. The plastic material should not absorb/release odours. It should be used in an environment with no appreciable odour and where all the applying safety requirements are observed.

7 Panel selection

Panel selection should follow of EN 13725:2022, 6.7.1.

8 Sampling

The odorant (or odorant in air) sample shall be kept in containers made of suitable materials, in which no chemical reactions between odorant and the container can occur. For sampling, see EN 13725:2022.

9 Safety precautions

The toxicological data of the fluids to be tested shall be taken into account before establishing the concentrations to be tested by the smellers, avoiding reaching concentrations that can be dangerous to human health.

10 Environmental conditions

Smellers should not be disturbed by environmental conditions (temperature, humidity, noise and light). If the environmental conditions are not controlled, the influence of any changes shall be taken into account in the uncertainty balance. The odour background should be avoided.

11 Panel calibration: training and examination

The panel training is performed with known concentrations of the standard odorant THT (Tetrahydrothiophene) with a purity of not less than 98 %. The values are derived by the "basic odourization" project, using two of the three values for THT, the detection threshold and the certainty threshold (see References [17] and [18]). A panel member has to be qualified to be able to recognise different smells and intensities (see [Clause 7](#)).

Table 2 — Concentrations of THT for panel training

Odour intensity (olfactory degrees)	THT concentration $\mu\text{g}/\text{m}^3$
0	0,0
1	5,5
2	16,6
3	50,0
4	150,7
5	454,5
6	1 370,2

NOTE Olfactory degrees 7 to 10 are not used for training purposes.

The smellers' training is performed by presenting at least three times all the concentrations of [Table 2](#) and teaching the corresponding olfactory degree.