

Natural gas — Olfactory method for the evaluation of odour intensity

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/iso/18222-2023-07-19/iso-dts-18222>

Warning for WDs and CDs

~~This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.~~

~~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.~~

© ISO 2022

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

FDIS stage

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/DTS 18222

<https://standards.iteh.ai/catalog/standards/sist/e1f6f4e5-fed7-446a-9188-be64e8838ef4/iso-dts-18222>

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11
~~Email~~E-mail: copyright@iso.org
Website: www.iso.org~~www.iso.org~~

Published in Switzerland

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO/DTS 18222

<https://standards.iteh.ai/catalog/standards/sist/e1f6f4e5-fed7-446a-9188-be64e8838ef4/iso-dts-18222>

Contents

Foreword	v
Introduction.....	vi
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	4
6.3 Dynamic olfactometer.....	4
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.....	6
13 Time between two presentations.....	6
14 Expression of the results.....	7
15 Precision of the method	7
16 Uncertainty of the method	8
16.1 Calculation of uncertainty	8
16.2 Uncertainty of the odour intensity corresponding to a stated concentration.....	8
16.3 Uncertainty of the concentration corresponding to a stated odour intensity.....	9
16.4 Numerical example of uncertainty calculations.....	11
17 Test report.....	12
Bibliography	13

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/DTS 18222

<https://standards.iteh.ai/catalog/standards/sist/e1f6f4e5-fed7-446a-9188-be64e8838ef4/iso-dts-18222>

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~~ ~~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*

~~ISO 19739, Natural gas — Determination of sulfur compounds using gas chromatography~~

~~EN 13725:2022, Air quality — Determination of odour concentration by dynamic olfactometry~~

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5492 ~~and~~ 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

~~The following general definitions apply to the human ability for sensation, awareness and~~ **3.1.1 odour intensity of odour perception.**

~~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](#) ~~Table 1~~).

3.1.2

odour perception

awareness of the effect of volatile substances by the olfactory organ

[SOURCE: ISO 14532:2014, ~~definition~~ 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

~~[ISO 5492]~~

[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 ~~the~~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[15].]

[SOURCE: ISO 14532:2014, ~~definition~~ 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[15].]

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 ~~sub-clause 6.7.1~~ 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~~[basic odourization](#)" project, using two of the three values for THT, the "~~Detection Threshold~~[detection threshold](#)" and the "~~Certainty Threshold~~[certainty threshold](#)" (see [References \[17\[15\]\]](#) and [\[18\[16\]\]](#)). A panel member has to be qualified to be able to recognise different smells and intensities (see [Clause 77](#)).

Table 2 — Concentrations of THT for panel training

Odour intensity (olfactory degrees)	THT concentration $\mu\text{g}/\text{m}^3$
0	0,0

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

NOTE Odour 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.

After the training every smeller is subjected to examination; unknown samples of odorant are presented to him/her: the smeller shall give his/her olfactory judgement about the odour intensity. Every mistake brings about a penalty, following [Table 3](#).

Table 3 — Penalties table

Olfactory judgements	True values						
	0	1	2	3	4	5	6
0	0	1	3	7	9	10	10
1	1	0	1	6	9	9	10
2	4	1	0	2	7	8	9
3	9	8	2	0	3	3	7
4	10	9	9	5	0	1	5
5	10	10	9	9	3	0	3
6	10	10	9	9	7	3	0

A smeller is qualified if the average of the obtained penalties is equal to $2\frac{1}{2}$ penalties or less. Training shall be repeated when a smeller does not reach the minimum score during examination.

The smellers' training and examination shall be performed at least once a year: every concentration is presented twice, randomly.

The sample presentation during both training and examination shall follow the same procedure which is adopted during the tests.

Before every uninterrupted series of olfactory evaluations (e.g. continuous measurement on several days), it is recommended to perform a pre-test examination for every smeller, to prevent a smeller from participating in the tests when his/her olfactory perceptions are altered (for example for a light disease). An example of this kind of test is here presented: one of the concentrations of [Table 2](#) is presented to every smeller and the corresponding value of odour intensity is made known; then another sample is presented to every smeller, but this time the value of odour intensity is unknown to the smeller. The pre-test examination is passed if the tester gives a correct assessment, with a tolerance of ± 1 olfactory degree. If the smeller does not give the correct assessment, he/she cannot participate in the olfactory evaluations.