

DLG Expert report 7/2017

# Practice guide for sensory panel training

Part 1: Requirements in accordance with DIN EN ISO 8586:2014-05



The withdrawal of DIN 10961:1996-08 'Training of assessors for sensory analysis' and its replacement by DIN EN ISO 8586:2014-05 'Sensory analysis – General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors' results in changed requirements for the selection of sensory panel members, their regular training and the monitoring of their assessment performances.

Due to the high complexity of the standard and the resulting difficulties in its practical implementation, the DLG Sensory Analysis Committee has prepared a practice guide consisting of three parts. Part 1 focuses on the sensory panel selection and training requirements that are described in DIN EN ISO 8586:2014-05. Part 2 describes training plans for sensory panel qualification for various application areas. Part 3 of the guide deals with the technical requirements of and the practical options for continuously monitoring the assessors' or the sensory panel's performance. The practice guide can not and is not intended to act as a substitute for obtaining and reading DIN EN ISO 8586 and the other specified standards, but should instead supplement them. It is to be regarded as an 'aid to interpretation' and aims to provide instructions for implementing the standard content in practice.

The content of the following Part 1 of the practical guide, which is focussed on sensory panel selection and training, is structured in modular form so that training units and modules can be selected on a project basis depending on the sensory panel qualification requirements. This is intended to provide exemplary advice concerning practical implementation to sensory analysis specialists and managers who are tasked with sensory panel qualification and work in the fields of food production, commerce, analysis and research institutions, official monitoring and also training and teaching. The content in the following still requires constant adaptation to company- and project-specific circumstances and requirements.

Section 4 of the European standard DIN EN ISO 5492:2008+A1:2017 first describes the selection of sensory assessors and compares the various types of assessor panels. Since the formulations selected here alone provide stimuli for discussions, the different types of sensory panels should be briefly presented in the following as an introduction to the topic. The assessment environment additionally plays a significant role in sensory analyses, particularly in the field of analytical tests; certain aspects of this will therefore also be explained in advance.

## 1. Sensory assessors and assessment rooms

### 1.1. Types and origin of sensory panels

DIN EN ISO 5492:2008+A1:2017 defines a sensory panel or a sensory assessor group as a group of sensory assessors participating in a sensory analysis.

In terms of these sensory assessors, a distinction is made between:

- **'Naive assessors'**, i.e. persons who do not meet a specific criterion (can be consumers, etc.)
- **'Initiated sensory assessors'** who have already taken part in a sensory analysis
- **'Selected assessors'** who have been selected to conduct a sensory analysis on the basis of their demonstrated special skills and suitability.

**'Expert sensory assessors'** are regarded as selected assessors who are demonstrably able to carry out sensory analyses of various products consistently, reliably and repeatably (good repeatability) based on the demonstrated sensitivity of their sensory perceptions, their continuous training, their experience and their long-term memory in terms of sensory testing.

An **'expert'** is defined as a person who, through knowledge or experience, has the competence required to give an opinion in the fields about which he/she is consulted. (DIN EN ISO 5492:2008+A1:2017, 1.5-1.10)

Further task areas are concerned, on the one hand, with those of a **panel leader**, who is qualified to lead a sensory panel usually used for analytical assessments and, on the other hand, those of an **assessment director**, who designs, controls and monitors the entire sensory analysis project, documents and evaluates the test results, summarises them in the final report and ultimately presents them to the client. In addition, **sensory analysis managers** (see DIN Certco and ISO 13301-1) are persons who fulfil management functions: planning of sensory analyses, administrative tasks including budget management and reporting, internal and external contact establishment/maintenance, product and method knowledge concerning sensory analysis.

According to the origin of the sensory assessors, the sensory panels used for sensory analyses can be subdivided into the following pursuant to the statements in DIN EN ISO 8586:

- **Internal panels** – these persons are recruited within the organisation or company. These are employees from administration, marketing, production, quality assurance and management, etc., i.e. persons from the company who may be familiar with sensory analysis but do not necessarily have to be.
- **External panels** – these persons are recruited outside of the organisation. They can also be familiar with sensory analysis or may be unfamiliar with the subject; the crucial aspect is that they do not belong to the company.
- **Mixed panels** – these involve a combination of persons who belong to the company or are externals.

DIN EN ISO 8586 provides a very good overview both in the introductory text (see DIN EN ISO 8586, p. 4-5) and in Section 4 'Selection of sensory assessors' as regards the acquisition and recruitment of sensory panel members and as regards the consideration of general requirements concerning the assessor's personality, lifestyle and modes of behaviour (e.g. availability, attitude towards food, communication skills or also psychological criteria and team skills, etc.). The advantages and disadvantages of internal or external sensory panels and the possible approaches to recruiting sensory panels are additionally described in detail; these points are therefore not dealt with in greater detail here (see DIN EN ISO 8586, p. 7-10).

In sensory analysis, a distinction is made between objective analysis methods and hedonic analysis methods depending on the technical issue and the accordingly selected analysis methodology. The requirements for the sensory panels and their capabilities and skills can be defined on the basis of these methods.

While consumer panels, i.e. untrained sensory assessors (naive assessors), whose selection procedures and screening are usually focussed on demographic criteria and consumption habits, are used in the case of hedonic analyses, screened and trained sensory assessors (expert sensory assessors) form the basis for objective sensory panels in analytical sensory analysis in terms of their sensory capabilities. As regards their capabilities, these must be able to deliver reliable, high-quality, objective and reproducible results (validity, reliability, objectivity, practicability) in a manner similar to a 'measuring instrument in a laboratory'/'laboratory instrument'.

The procedure for selecting, training and reviewing selected assessors and expert sensory assessors described in DIN EN ISO 8586 is focussed on sensory assessors or sensory panel members who can be used within the framework of objective sensory analyses. The reason for this is that their sensory capability extensively determines the quality and reliability of the respective analysis result.

Depending on the origin and qualification of the sensory assessors and depending on the sensory issue or the sensory analysis project, the sensory panel leader must select corresponding procedures for checking sensory skills, for familiarisation with the analysis tasks and for training measures within the area of sensory analysis. The screening and training of a sensory panel for discrimination tests, for instance, should focus on the recognition and description of sensory differences, with the result that matching tests, triangle and paired comparison tests are dominant. Conversely, sensory panel training for descriptive analyses is focussed on the description of sensory characteristics and product differences as well as the recognition and rating of intensities. 'Simple descriptive test', 'conventional profiling' or 'consensus profile' as well as the quantitative rating of the attributes on various intensity scales that are trained beforehand can form the focus of the training units in this case.

## 1.2. Requirements for sensory test rooms

While hedonic tests by consumers usually take place consciously in various locations and under diverse test conditions, e.g. in the form of a home use test at the consumer's home, in the form of a central location test in a department store or in a square in the open air rather than in a test laboratory, the performance of sensory analysis tests, like a technical analysis device in a laboratory, necessitates a standardised test environment.

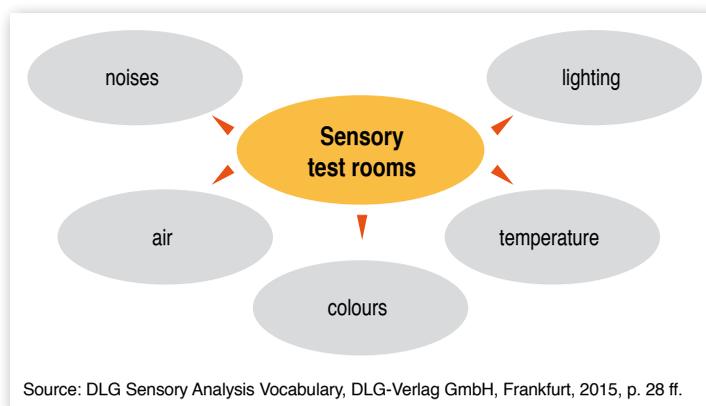


Figure 1: Requirements for sensory test rooms

The requirements for sensory test rooms are described in detail in DIN EN ISO 8589:2010+A1:2014 – Sensory analysis – General guidance for the design of test rooms, and can also be looked up there.

On the basis of a cost/benefit analysis, each company must decide the extent to which all of the criteria recommended therein can or should be implemented. Often, the introduction to sensory analysis initially takes place using an existing meeting room equipped with a large, round table or several tables arranged flexibly in the room, on which small partition walls can be installed if necessary. Later on, the rooms are then often successively extended, and test booths may possibly also be purchased. Taking into account the fact that ‘the test rooms deliver known, controlled conditions with minimum distraction of the sensory panel members as well as the extensive reduction of psychological factors and physically-related influences on human judgement’ (see DIN EN ISO 8589), the following aspects must be observed when designing test rooms in the context of sensory analysis tests (see Figure 1):

### Location and scope of the test area

Depending on circumstances at the company, the test area should consist of at least two rooms: a test room with individual, firmly installed or mobile test booths or test benches with or without partition walls for individuals or groups of people and a room for sample preparation (e.g. laboratory and/or kitchen), access to which is reserved exclusively for the sensory panel leader and his/her staff. Further rooms, ideally located in the test environment, are additionally necessary and should be easily accessible. These should include, for example, an office for result evaluation, a storage room for the samples, a cloakroom, toilets and possibly an additional lounge and break room for the sensory assessors. The closer the individual rooms are located together, the more efficiently a sensory test procedure can be organised. If data collection by the assessor panel is carried out using IT, the required hardware and software must be made available. Means for neutralising the senses and spittoons must additionally be provided.

### Noises

High concentration during the sensory tasting and assessment process necessitates a disturbance-free, quiet environment. This means that road noise must be avoided exactly like noise caused by food production. Ideally, the floor in the test room is soundproofed so that noises caused by walking or moving/rolling objects are also minimised.

### Lighting

Proper (adapted to the test sample), uniform, adjustable and virtually shadow-free lighting is required in the test room for an objective assessment of appearance. Artificial lighting that simulates natural light is ideal. As per the international standard, a colour temperature range of 6,000 - 6,500 K (Kelvin) is suitable for achieving good, neutral natural light corresponding to ‘northern daylight’. Light sources with a high colour rendering index of 5,000 K - 5,500 K are required to simulate ‘natural midday light’. If colour impressions are to be masked, working with red light, black light or colour filters is sensible. A light control system or a dimmer is also pleasant.

### Temperature and relative humidity

The temperature of the test sample is crucial for its proper assessment. Product-specific target requirements for both the storage of the test sample (cooling facilities such as a refrigerator, freezer cabinet) and the tasting temperatures for the respective products should therefore be established. Continuously monitoring these must be ensured. Depending on product group, this could be e.g. +2 to +8°C (tolerance  $\pm 2^\circ\text{C}$ ) in a refrigerator and -20 to -18°C (tolerance  $\pm 2^\circ\text{C}$ ) in a freezer. Thermometers for measuring and monitoring these requirements, for checking the room temperature and also for determining/measuring the temperature at which the product can be consumed are required. Equipping the test room with an air conditioning system is ideal so that the room temperature and the humidity can be controlled. Experience from practical sensory analysis shows that the room temperature should be a pleasant  $20 \pm 3^\circ\text{C}$  and the relative humidity should be  $> 40$  and  $< 50\%$ .

### Colours

It is crucial that neither the test portions nor the assessors are influenced by the colour scheme of the test room. The furnishings, particularly the test bench and the walls in this case, should be of a neutral design with light beige, stone white or light grey colours. As an exception, the floor and also the chairs can be designed in a different colour.

### Air

The perception of odours in the test room may not be disturbed by off-odours (e.g. environmental odours, kitchen odours, odours of cleaning agents or technical odours). Nor should easily cleaned furniture or auxiliary test equipment (plates, cutlery, drinking beakers, etc.) give off any negative odours that could affect the assessment of the test sample. The availability of an adjustable ventilation system is ideal.

## 2. Description of various modules and test tasks for sensory panel training for sensory analysis tests

As mentioned previously, international standard DIN EN ISO 8586:2014-05 provides guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors.

In this standard, the objective of sensory panel training is described as follows:

'[...] to equip sensory assessors with fundamental knowledge regarding the procedures employed in sensory analysis and to develop their ability to perceive, recognise, describe and discriminate sensory stimuli.' [P. 15 ff.]

Various methods and procedures can be used to train and monitor sensory perception. All training measures conducted in the case of analytical sensory panel members are focussed on the development of a long-term sensory memory which is then able, in the context of sensory analyses, to place sensory perceptions into relationship with what has been learnt and previous experiences, and to deliver comprehensible, reliable analysis results.

DIN EN ISO 8586 makes **suggestions** for the various approaches, listed in the following, subsequent to the recruitment of potential sensory assessors:

- Preliminary selection tests (see point 2.1, p. 5)
- Methods for training and final selection of the sensory assessors (see point 2.2, p. 9)
- Management and continued existence of the group (see point 2.3, p. 16)
- Monitoring and testing the performance of the selected sensory assessors and expert sensory assessors (see Part 3 of the sensory panel training guideline)

It is sensible and expedient to orient the sensory tests and training courses to the products to be tested later on and the planned test methods (discrimination tests or descriptive tests) and to start with easier test tasks if necessary.

Amongst others, the following test methods are generally recommended in DIN EN ISO 8586:2014-05:

- **Recognition tests and matching tests**, for determining the capability of the sensory organs as regards to the perception of colours, basic tastes, textures and odours.
- **Threshold tests**, for registering the sensitivity of the sensory organs as regards to the perception of the intensities of colours, basic tastes, textures and odours. Threshold tests can be used to ascertain the individual stimulus, recognition and difference thresholds of the assessors. Repeat measurements are sensible to give consideration to the assessors' personal, momentary performance.
- **Ranking tests**, for determining the capability to categorise defined intensities of sensory attributes into a systematic ranking/sequence. This can be applied to sample sets with different quantitative characteristics in terms of colour, taste, odour or texture (e.g. hardness).
- **Discrimination tests or comparison tests**, for registering the discriminating ability of sensory assessors. These are also used to confirm determined threshold values. The triangle test or the paired comparison test are often used.
- **Descriptive tests**, such as the 'simple descriptive test' for determining the verbal expressiveness of the sensory assessors as regards sensory perceptions.

Overview of the possible **tests and minimum requirements** presented in DIN EN ISO 8586:2014-05 for the preliminary selection, training and selection of assessors for assessor panels in the context of sensory analysis tests: (Source: own figure)

#### Preliminary selection

Test	Objective	Method	Minimum requirement	Practice guide reference
Module 1	Colour vision: Recognition of colours and discrimination of intensities in - bright colours - grey colours	Ishihara test Munsell test Ranking test with colour series	Two errors pertaining to two neighbouring samples are permissible in each test series with 10 or 11 samples.	2.1.1.1, p. 8
Module 2	Taste/odour blindness: Recognition of basic tastes, odours	Matching test	... Candidates who assign fewer than 80% of the samples to the original set correctly should not become selected assessors.	2.1.1.2, p. 9

#### Training

Test	Objective	Method	Minimum requirement	Practice guide reference
Module 3	Stimulus perception/stimulus threshold: Determination of sensitivity in the perception of odours and basic tastes	Threshold test/stimulus threshold test  Triangle test (taste)	Ideally, the candidates' responses should be 100% correct. If the candidate is unable to perceive differences even after several repetitions, he/she is unsuitable for this type of test.	2.2.1.1, p. 10
Module 4	Recognition and differentiation of intensity levels of a stimulus (taste, odour, texture, colour)	Paired comparison test Ranking test	With this task, successful completion can only be determined in relation to the intensities used in each case. The following applies for these concentrations: candidates who confuse the order of more than one neighbouring sample pair must be considered unsuitable as selected assessors for this type of analysis.	2.2.1.2, p. 10

Test	Objective	Method	Minimum requirement	Practice guide reference
Module 5	Recognition of powers of description	Simple descriptive test  Odour description on the basis of standardised odours  Texture description	Rating is carried out based on a scale: - 3 points for the correct recognition or the description of the most frequent association - 2 points for a description using a general designation - 1 point for the identification or description of an appropriate association following the discussion - 0 points if no response is forthcoming or is completely incorrect - Successful completion is defined separately depending on the substances used.  <i>See previous DIN 10961: Odour 70% correct responses; texture: 80% correct responses</i>	2.2.1.3, p. 10-12
Module 6	Recognition of differences in texture	Ranking test	At least 80% of the samples must be ranked in the correct sequence.	2.2.1.4, p. 12
Module 7	Perception and recognition of special types of taste and odours	Matching Recognition test Paired comparison Triangle test Duo-trio test	Minimum requirements must be defined depending on the project and for the specific company.	2.2.1.5, p. 13
Module 8	Application of scales	Familiarisation with scales: Assessment scale Classification scale Interval scale Ratio scale	Minimum requirements must be defined depending on the project and for the specific company.	2.2.1.6, p. 14
Module 9	Development and use of descriptors/vocabulary (profile)	Simple descriptive test Group discussion	Minimum requirements must be defined depending on the project and for the specific company.	2.2.1.7, p. 14
Module 10	Specific product training	Depending on the planned application area of the sensory panel (discrimination or descriptive tests)	Minimum requirements must be defined depending on the project and for the specific company.	2.2.1.8, p. 14

## 2.1. Preliminary selection tests

The preliminary selection of sensory assessors is used to check the sensory capabilities of recruited persons and to familiarise the potential sensory assessors with the products and materials to be tested.

As per DIN EN ISO 8586, the sensory methods to be used are subdivided into three different areas:

- Determination of physiological impairments (e.g. odour, taste, colour blindness)
- Ascertainment of sensory sensitivity
- Registration of sensory capabilities with regard to the description and communication of sensory perceptions

According to the information in DIN EN ISO 8586, focus should be placed more on the sensory potential of the candidates with regard to planned projects and application areas than on their present performances or their current performance level during the preliminary selection of sensory assessors, the reason being that this can be successively increased through regular, appropriate training.

Note: it has been shown in practice that the methods for ‘... the description and communication of sensory perceptions’ listed under preliminary selection in the standard are more appropriate for use during sensory panel training.

The procedure for determining basic assessor suitability is described in greater detail in the following, but it must be pointed out that the standard is recommendatory in character. This implies that the methods and substances described here can be used but do not have to be used in their entirety. The objective of the project and the required sensory methods for which the sensory panel is to be selected and qualified (e.g. discrimination tests or descriptive tests) are crucial to the selection of the modules. Likewise, the substance concentrations specified here and in the training plans (in Part 2 of the guide) are guideline values that must be adapted to company-specific empirical values.

### 2.1.1. Determination of physiological impairments (e.g. anosmia)

#### 2.1.1.1. Module 1 – colour vision

The Ishihara test (see Figure 2) or the Farnsworth Munsell 100 hue test can be performed to start off the determination and evaluation of physiological impairments in terms of colour vision. The correct recognition of colours can also be tested by means of colour test series (from yellow and green to blue or from red and violet to blue).

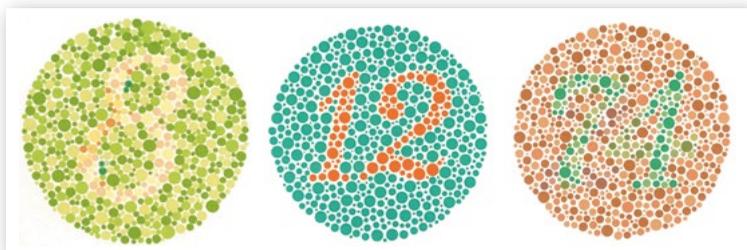


Figure 2: Examples from an Ishihara test

The determination of sensory sensitivity in terms of colour vision can be carried out through tests to rank the different intensities of a colour series (e.g. red, green, grey). According to the specifications in DIN EN ISO 8586, various colour series are possible and have to be produced beforehand. This procedure is described in detail in the standard, p. 13-14; only the main features should therefore be outlined here. Only reagents that are of analytical purity may generally be used; this also applies to distilled or demineralised water.

The following colour test series/rankings can be used to determine discriminatory sensitivity:

#### **Task: discrimination between various colour intensities in the wet medium**

- Colour test series from yellow to green and blue: Quinoline Yellow (CAS 8004-92-0) and Patent Blue V (CAS 3536-49-0)
- Colour test series from red and violet to blue: Azo Rubine (CAS 3567-69-9) and Patent Blue V (CAS 3536-49-0)

#### **Task: discrimination between various colour intensities in the dry medium**

- Test with grey colour from light to dark: homogeneous mixture of starch (natural, low water content) (CAS 9005-25-8) and graphite (CAS 7782-42-5), to be produced in defined mass percentages.

#### **Minimum requirement:**

Two errors pertaining to two neighbouring samples are permissible in each test series with 10 or 11 samples.

#### 2.1.1.2. Module 2 – taste and odour blindness

The objective in this case is to test the candidates as regards their sensitivity to various fragrance and taste substances that can frequently occur in low concentrations in food in order to rule out taste or odour blindness. Corresponding samples with concentrations that are significantly higher than the threshold value are used for this. The initial registration of capabilities concerning the description and verbal communication of sensory perceptions is also the object of these test methods.

**Task: A matching test** (see ISO 6658) should initially be conducted to familiarise the candidates with a series of coded samples (original set). They are subsequently given a series of the same samples of at least twice the number with modified coding, and should then assign these to the original set and describe their sensory perceptions.

Above all, this procedure tests the recognition of the basic tastes and those odours that are of relevance for the subsequent tests. The products that can be used for this test are described in detail in DIN EN ISO 8586 in Table 3, p. 15. Only an overview will therefore be provided in this regard in the following.

Excerpt from DIN EN ISO 8586 Table 3 – examples of taste- or odour-related substances and concentrations in preliminary selection tests (see DIN EN ISO 8586, p. 15)

Taste or odour	Substance	CAS no.
<b>Taste</b>		
Sweet	Cane sugar (sucrose)	57-50-1
Sour	Citric acid	77-92-9
Bitter	Caffeine	58-08-2
Salty	Table salt (sodium chloride)	7647-14-5
Umami/meat broth	Monosodium glutamate or mixture of mass percentages (50% monosodium glutamate, 25% disodium guanylate, 25% disodium inosinate)	142-47-2 5550-12-9 4691-65-0
Astringent	Tannic acid or quercetin or potassium aluminium sulphate (alum)	1401-55-4 117-39-5 7784-24-9
Metallic	Iron(II) sulphate heptahydrate, $\text{FeSO}_4 \cdot 7 \text{H}_2\text{O}$	7782-63-0
<b>Odour</b>		
Lime, fresh	Citral ( $\text{C}_{10}\text{H}_{16}\text{O}$ )	5392-40-5
Vanilla	Vanillin ( $\text{C}_8\text{H}_8\text{O}_3$ )	121-33-5
Thyme	Thymol ( $\text{C}_{10}\text{H}_{14}\text{O}$ )	89-83-8
Flowery, lily of the valley, jasmine	Benzyl azetate ( $\text{C}_9\text{H}_{10}\text{O}_2$ )	140-11-4

Note: to be correct, 'astringent' and 'metallic' are not taste impressions. The impression of astringency is perceived via the trigeminal nerve, not via the taste buds.

#### Minimum requirement:

With these substances and the concentrations specified here, it is generally recognised that candidates who assign fewer than 80% of the samples correctly to the original set should not become selected assessors. The correct description of the sensation that is triggered by the substance in the sample is desirable, but initially of less importance in this case.

## 2.2. Training and final selection of the sensory assessors

Generally, the number of sensory assessors trained should always be one and a half to twice the final number of sensory panel members required by the panel leader and the varying number of sensory panel members specified depending on the sensory method.

### 2.2.1. Methoden zur Schulung von Farbe, Geschmack, Geruch und Textur

The objective of the training measures is to qualify the sensory assessors with knowledge concerning the methods and procedures involved in sensory analysis so that they develop skills to perceive, recognise, describe and distinguish sensory stimuli. It is also important to practice the application of these procedures with the aid of products of relevance to the respective issue.

The following procedure or sequence has proved sensible during practical performance:

- Appearance (mainly colour)
- Odour (pronasally when smelling)
- Texture
- Taste and retronasal odour perception
- After-taste

When testing odours, the sensory assessors must be trained to sniff briefly rather than for long periods and not too frequently so that they do not become irritated, since this leads to adaptation and fatigue.

### 2.2.1.1. Module 3 – stimulus perception tests (perception of a stimulus)

The stimulus perception tests are carried out on the basis of a triangle test (DIN EN ISO 4120:2007). In this process, the candidate is provided with either a) a stimulus (single sample) together with two water samples (double sample) for comparison or b) two samples of the product (double sample), which must then be compared with a water sample (single sample). The products, the concentration and the neutral medium must be selected by the panel leader or the organiser of the exercises in terms of the tests and ratings in which the candidates are to be used. The procedure for preparing the test portions (mass concentration or proportion by volume in water) is described in detail in DIN EN ISO 8586 in Table 4, p. 17. Only an excerpt from this is shown.

*Excerpt from DIN EN ISO 8586 Table 4 – examples of reference substances that may be used for the stimulus threshold test (see DIN EN ISO 8586, p. 17)*

Reference substance	CAS no.	Taste
Caffeine	58-08-2	bitter
Citric acid	77-92-9	sour
Sodium chloride	7647-14-5	salty
Sucrose	57-50-1	sweet
Monosodium glutamate	142-47-2	umami
Iron(II) sulphate heptahydrate	7782-63-0	metallic
(Z)-3-hexen-1-ol (leaf alcohol)	928-96-1	green, grassy, unripe

#### Minimum requirement:

Ideally, the candidates' responses should be 100% correct. If the candidate is unable to perceive differences even after several repetitions, he/she is unsuitable for this type of test.

### 2.2.1.2. Module 4 – tests for discriminating between the intensity levels of a stimulus

The tests for determining the ability to discriminate between the intensity levels of a stimulus are carried out on the basis of a ranking test in accordance with DIN ISO 8587:2010-08 or by means of paired comparisons. They are designed and conducted using samples for testing taste, odour (low concentrations), texture (mouth, hand) and colour. The substances and concentrations used to produce the samples are shown in DIN EN ISO 8586, Table 5, p. 18; the following table therefore only provides an overview of the reference substances.

*Excerpt from DIN EN ISO 8586 Table 5 – examples of reference substances that can be used in ranking tests (see DIN EN ISO 8586, p. 18)*

Test	Reference substance	Description
Taste discrimination – paired comparison or ranking	Citric acid	sour
Odour discrimination – paired comparison or ranking	Isoamyl acetate	fruity
Texture discrimination	Appropriate to the respective branch of industry (e.g. cream cheese, puree, gelatine)	creamy, hard, viscous, etc.
Colour discrimination	Fabric cloth, colour scales, etc.	red, green, etc.

#### Minimum requirement:

With this task, successful completion can only be determined in relation to the intensities used in each case. The following applies for these concentrations: Candidates who confuse the order of more than one neighbouring sample pair must be considered unsuitable as selected assessors for this type of analysis.

### 2.2.1.3. Module 5 – tests for recognising powers of description

In order to recognise the extent to which the candidates are able to describe sensory perceptions, two tests should be conducted, one of which deals with odour and the other with texture.

#### Odour description tests

In this regard, the candidates are presented with between 5 and 10 standardised odour substances that should ideally refer to the subsequent object of the analysis. The sample set must contain both easily recognised and also less common

odours, the concentration of which should lie clearly above the recognition threshold, but not too much higher than the level that usually occurs in the products.

The procedure for sample preparation includes both the retronasal variant, whereby the odours (aromas) are picked up via an aqueous solution, and an orthonasal procedure. In this process, the odours can be offered in glass containers as well as using smelling strips, capsules or sniffing sticks. The precise procedure in this regard is described in DIN EN ISO 8586, p. 18-20. Examples of reference substances for testing the description of odours are shown as an excerpt from Table 6 of the standard.

*Excerpt from DIN EN ISO 8586 Table 6 – examples of reference substances for testing the description of odours (see DIN EN ISO 8586, p. 20)*

Reference substance	CAS no.	Name most frequently associated with the odour
Benzaldehyde	100-52-7	bitter almond, cherry
Octen-3-ol	3391-86-4	mushrooms
(Z)-3-hexen-1-ol	928-96-1	green grass
(S)-(+)-carvone	2244-16-8	caraway seed
$\gamma$ -nonalactone	104-61-0	coconut
Diacetyl	431-03-8	butter
Cinnamaldehyde	104-55-2	cinnamon
Phenyl acetate	122-79-2	flowers
Diallyl disulphide	2179-57-9	garlic
Camphor	76-22-2	camphor, medicine
Menthol	1490-04-6	peppermint
Eugenol	97-53-0	cloves
Anethol	104-46-1	aniseed
Vanillin	121-33-5	vanilla
$\beta$ -ionone	79-77-6	violets, raspberries
Butyric acid	107-92-6	rancid butter
Acetic acid	64-19-7	vinegar
Isoamyl acetate	123-92-2	fruit, acid drops, bananas, pears
Dimethyl thiophene	638-02-8	grilled onions

Note: food, spices, extracts, infusions or chemical odour substances can be used. The selected reference substances must correspond to the regional circumstances and be free of other odour substances (DIN ISO 3972:2013-12).

#### Minimum requirement:

Rating is carried out based on a scale:

- 3 points for the correct recognition or the description of the most frequent association
- 2 points for a description using a general designation
- 1 point for the identification or description of an appropriate association following the discussion
- 0 points if no response is forthcoming or the response is completely incorrect

Successful completion is determined separately, because it can only be determined in relation to the respectively used odour substances in this task.

The following minimum requirements were defined in the previous DIN 10961:1996-08:

Odour: 70% correct responses.

The user should decide individually a) which minimum requirements he/she makes on the panel members and b) which form – points system or % values – he/she intends to use.

### Texture description tests

A range of products is presented to the candidates in a random sequence in this process. If they are presented in solid form, the product samples should have a uniform size. If they are presented as liquid samples, containers that do not permit any conclusions whatsoever to be drawn regarding possible differences should be selected.

Example substances in this regard are described in DIN EN ISO 8586, p. 20. An excerpt is shown in the following.

*Excerpt from DIN EN ISO 8586 Table 7 – examples of products for testing the description of textures (see DIN EN ISO 8586, p. 20)*

Product	Texture most frequently associated with the product
Oranges	juicy, cell-like segments
Breakfast cereals (cornflakes)	crispy, crunchy
Pears (Passe Crassane)	coarse-grained, juicy
Granulated sugar	crystalline, coarse-grained
Marshmallow top layer	sticky, formable
Chestnut puree	pulpy/paste-like
Semolina	grainy
Double cream	smooth, creamy
Edible gelatine	rubbery
Corn cake	crumbly
Cream toffee	sticky
Squid	elastic, resilient, rubbery
Celery	fibrous
Raw carrots	crunchy, hard

#### Minimum requirement:

Rating is carried out based on a scale:

- 3 points for the correct recognition or the description of the most frequent association
- 2 points for a description using a general designation
- 1 point for the identification or description of an appropriate association following the discussion
- 0 points if no response is forthcoming or the response is completely incorrect

Successful completion is determined separately, because it can only be determined in relation to the respectively used substances in this task.

The following minimum requirements were defined in the previous DIN 10961:1996-08:

**Texture:** 80% correct responses.

The user should decide individually a) which minimum requirements he/she makes on the panel members and b) which form – points system or % values – he/she intends to use.

### Module 6 – tests for recognising differences in texture

The test for recognising differences in texture is based on the ranking test method in accordance with DIN ISO 8587:2010-08. In this process, gelatine samples of the same size, but with different firmnesses are presented. Each sensory assessor is presented with all samples in a random sequence, tests each sample by touching it and then sorts them into a systematic sequence according to firmness. The procedure for producing the gelatine samples is described in detail in DIN EN ISO 8586 on p. 21 ff. and is therefore not dealt with specifically here.

#### Minimum requirement:

At least 80% of the samples must be ranked in the correct sequence.

### 2.2.1.5. Module 7 – training of the perception and recognition of special types of taste and odours

Matching, recognition, paired comparison, the triangle test and the duo-trio test (see ISO 6658) must be used to clearly indicate differences in taste between higher and lower concentrations in sensory panel training. The sensory assessors should be able to correctly recognise and describe the differences. When training sensitivity with regard to odour stimuli, these first have to be presented in the form of an aqueous solution before – as the sensory assessors become more experienced – any food or beverages that are available and relevant for the subsequent test task can be used. Mixed samples with several components with varying proportions may then also be used. The samples must be presented in defined quantities and at the temperatures at which they are generally used or consumed. The number of samples that are presented must be limited to avoid fatiguing the senses and therefore reducing the perceptive capability. If conclusions concerning the differences in taste or odour could be drawn from the appearance of the samples, this influencing factor must be changed, e.g. by presenting the samples under coloured light or must be eliminated entirely, e.g. by using a blindfold in order to guarantee objectivity. As shown in DIN EN ISO 8586, Table 9, p. 22 ff., the following substances and products (excerpt from the standard) can be used to train perception and identification.

*Excerpt from DIN EN ISO 8586 Table 9 – examples of products that can be used to train perception and identification (see DIN EN ISO 8586, p. 22)*

Substance	CAS no.	Sensory description
<b>Taste</b>		
Cane sugar (sucrose)	57-50-1	sweet
Citric acid	77-92-9	sour
Caffeine	58-08-2	bitter
Table salt (sodium chloride)	7647-14-5	salty
Monosodium glutamate or mixture of mass percentages (50% monosodium glutamate, 25% disodium guanylate, 25% disodium inosinate)	142-47-2 5550-12-9 4691-65-0	umami/meat broth
Tannic acid or quercetin or potassium aluminium sulphate (alum)	1401-55-4 117-39-5 7784-24-9	astringent
Iron(II) sulphate heptahydrate, FeSO <sub>4</sub> · 7H <sub>2</sub> O	7782-63-0	metallic
Saccharine		sweet
Quinine sulphate		bitter
Grapefruit juice		bitter, astringent, grapefruit-like
Apple juice		sweet, fruity, apple-like
Sloe juice		sloe-like, bitter, astringent
Cold tea		tea
Benzaldehyde		almond
Sucrose contents of different concentrations		intensity of the sweetness
Tartaric acid in different concentrations and mixtures		intensity of the astringency
Yellow-coloured beverage with orange aroma; yellow-coloured beverage with lemon aroma		orange or lemon
Succession of caffeine, tartaric acid and sucrose		bitter, astringent, sweet
Succession of caffeine, sucrose, caffeine, sucrose		bitter, sweet, bitter, sweet
<b>Odour</b>		
Citral (C <sub>10</sub> H <sub>16</sub> O)	5392-40-5	lime, fresh
Vanillin (C <sub>8</sub> H <sub>8</sub> O <sub>3</sub> )	121-33-5	vanilla
Thymol (C <sub>10</sub> H <sub>14</sub> O)	89-83-8	thyme
Benzyl azetate (C <sub>9</sub> H <sub>10</sub> O <sub>2</sub> )	140-11-4	flowery, lily of the valley, jasmine
(Z)-hexen-3-en-1-ol (leaf alcohol)	928-96-1	green, grassy, unripe

**Minimum requirement:** To be defined depending on the project and for the specific company.

### 2.2.1.6. Module 8 – training on the use of scales

Depending on the scales to be used in the future, the sensory assessors must be introduced to the various types of scales: assessment scale and/or classification scale and/or interval scale and/or ratio scale (see ISO 6658 and ISO 4121). The various assessment methods are subsequently used to assign sensible orders of magnitude to the samples. Work must initially be carried out using substances dissolved in water before actual foods with mixed stimuli are introduced. Appropriate substances and their concentrations are listed in DIN EN ISO 8586 Table 10, p. 23 and can be looked up there in detail.

*Excerpt from DIN EN ISO 8586 Table 10 – examples of substances and products that may be used to train the use of scales (see DIN EN ISO 8586, p. 23)*

Example	Substance/product
1	Products from Table 4
2	Sucrose contents in various concentrations
3	Caffeine in various concentrations
4	Tartaric acid in various concentrations
5	Hexyl acetate in various concentrations
6	Cheese, e.g. matured hard cheese such as Cheddar or Gruyère cheese, or matured soft cheese such as Camembert
7	Pectin gels
8	Lemon juice and diluted lemon juice in various concentrations

**Minimum requirement:** To be defined depending on the project and for the specific company.

### 2.2.1.7. Module 9 – training the development and use of descriptors/vocabulary (profiles)

The sensory assessors must be introduced to the profile test, whereby a range of simple products are presented to them. In this process, they are expected to develop a vocabulary for describing the sensory product properties and characteristics. Wherever possible, these should be terms that enable the samples to be distinguished from one another. The terms must first be developed individually by the sensory assessors in the context of a simple descriptive test and then discussed so that a coordinated list with at least 10 terms is ultimately available. In this process, preference is to be given to practical product examples that will also be of importance in subsequent test tasks.

**Minimum requirement:** To be defined depending on the project and for the specific company.

### 2.2.1.8. Module 10 – specific product training

Following on from the fundamental training, the sensory assessors must undergo a product training phase. The procedure to be planned for this is dependent on the tasks the sensory panel will be called on to perform in the future. If focus is placed on identifying product differences, the various methods of the discrimination tests as per the applicable DIN and ISO standards must be taught. If the focus lies on descriptive tests, respective experience should be gained using a wide range of samples of one type of product with different characteristics. In this case, 10-15 samples of a product type can be presented per training course.

**Minimum requirement:** To be defined depending on the project and for the specific company.

### 2.2.2. Final selection of the sensory assessors/sensory panels for individual procedures:

The sensory assessors identified according to their sensory knowledge and capabilities can then be selected so that sensory assessor groups (sensory panels) can be compiled for specific sensory analyses and issues. If necessary, these should then undergo further specific training courses. Refer to DIN EN ISO 8586, p. 24 ff. for details in this regard.

The tests for which the selected sensory assessors can be used include those listed in the following. In each case, the number of sensory assessors per sensory panel must be oriented to the specifications contained in ISO 6658:

- **Difference assessment/discrimination test**  
Final selection to the sensory panel is based on constant performances in repeat tests for the sensory differentiation of current samples.
- **Ranking assessment/ranking test**  
Final selection to the sensory panel is based on constant performances in repeat tests for the sensory ranking of current sample series with various substance concentrations.
- **Assessment with the award of points**  
The selected sensory assessors must assess three lots of approximately six different samples arranged at random; if possible, this must be undertaken in more than one session. The results achieved in this process must be evaluated by means of an ANOVA or using the Friedman or Page test for each sensory panel member. Sensory assessors who reveal a high standard deviation – inconsistency, poor discriminating ability – should be excluded if necessary. However, the test design and the presented selection of samples must be checked for possible inconsistencies beforehand. The summarised results of the sensory panel must also be statistically analysed as a whole to enable conclusions concerning the ability of the sensory panel to discriminate and the homogeneity of the assessments to be drawn.
- **Qualitative descriptive analysis**  
No additional selection procedures other than those that have already been dealt with are recommended in this case.
- **Quantitative descriptive analysis**  
Based on their demonstrated capabilities and their suitability, sensory assessors are selected to pursue additional training measures in order to qualify as expert sensory assessors. To do this, the sensory panel members should be assessed by the panel leader over a defined period of time with regard to their performance in terms of repeatability, with regard to their sensitivity or with regard to their particular sensory suitability, e.g. recognition of taints.

The desirable characteristics of selected sensory assessors additionally include:

- Memory for sensory descriptors/attributes
- Ability to communicate with other sensory assessors
- Ability to put product descriptions into words.

### 2.2.3. Training of selected assessors to become expert sensory assessors/experts

One of the objectives for qualifying selected assessors to finally become expert sensory assessors is the optimisation and continued development of their sensory skills and methodological, practical capabilities. The sensory assessors should also obtain knowledge concerning the physiology of taste and odour. In particular, training courses serve to empower the sensory assessors to meet the requirements made on them in terms of their sensory discrimination ability (discrimination tests) and the recognition and memorisation of descriptors of a sensory profile and its intensities (descriptive test methods) and also to acquire the qualities required to create sensory profiles (repeatability, correctness, ability to discriminate).

The following criteria are generally taken into consideration in this:

- Sensory memory
- Learning the semantics and metrics of the sensory descriptors
- Establishment of a descriptor lexicon
- Training regarding rating conditions

### 2.3. Management and continued existence of the group

It is crucial to maintain both the motivation and the skills of the sensory panel so that the group can work efficiently. Amongst other methods, the sensory panel's qualifications can be maintained through the sensory panel members' regular participation in the tests, the provision of feedback regarding sensory analysis results or the performance of individuals, participation in round robin tests or also by means of regular retraining or sensory knowledge refresher courses. Carrying out selective tests at regular intervals (e.g. twice a year) to monitor the group's performance is also recommended. Sensory panel motivation must be taken into consideration separately, and can be maintained, for instance, by means of financial remuneration and/or small tokens of appreciation or gifts, or even by means of joint outings for team building purposes.

Topics such as renewing the sensory panel by including new sensory assessors and their retraining and integration into the sensory assessor group should also be taken into consideration from time to time.

### 3. Overview of relevant standards and literature references

- DIN EN ISO 5492: 2008-10 – Sensory analysis – Vocabulary
- DIN EN ISO 8586:2014-05 – Sensory analysis – General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors
- DIN EN ISO 8589:2014-10 – Sensory analysis – General guidance for the design of test rooms
- DIN EN ISO 4120:2009-08 – Sensory analysis – Methodology – Triangle test
- DIN ISO 8587:2010-08 – Sensory analysis – Methodology – Ranking
- DIN ISO 3972:2013-12 – Sensory analysis – Methodology – Method of investigating sensitivity of taste
- DIN EN ISO 13299:2016 – Sensory analysis – Methodology – General guidance for establishing a sensory profile (ISO 13299:2016)
- Busch-Stockfisch, Mechthild, Praxishandbuch Sensorik in der Produktentwicklung und Qualitätssicherung, B. Behr's Verlag GmbH & Co. KG, Hamburg
- Derndorfer, Eva, Lebensmittel-Sensorik, 5<sup>th</sup> Edition 2016, Facultas Verlags- und Buchhandels AG, Vienna, Austria
- DLG Sensory Analysis Vocabulary, DLG Sensory Analysis Committee, DLG-Verlag GmbH, Frankfurt/M., 2015
- DLG Expert report - Sensory Analysis, free to download from [http://www.dlg.org/expertenwissen\\_sensorik.html](http://www.dlg.org/expertenwissen_sensorik.html)

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DLG Sensory Analysis Committee – [www.DLG.org/sensorikausschuss.html](http://www.DLG.org/sensorikausschuss.html)

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