



BSI Standards Publication

## **Sensory analysis — Methodology — Balanced incomplete block designs**

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## National foreword

This British Standard is the UK implementation of ISO 29842:2024. It supersedes BS ISO 29842:2011+A1:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AW/12, Sensory analysis.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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**International  
Standard**

**ISO 29842**

**Sensory analysis — Methodology —  
Balanced incomplete block designs**

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blocs incomplets équilibrés*

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| Contents                                                                                 |                                                         | Page |
|------------------------------------------------------------------------------------------|---------------------------------------------------------|------|
| Foreword.....                                                                            |                                                         | iv   |
| 1                                                                                        | Scope.....                                              | 1    |
| 2                                                                                        | Normative references.....                               | 1    |
| 3                                                                                        | Terms and definitions.....                              | 1    |
| 4                                                                                        | Specification of balanced incomplete block designs..... | 1    |
| 5                                                                                        | Data analysis.....                                      | 2    |
| 5.1                                                                                      | General.....                                            | 2    |
| 5.2                                                                                      | Analysis of variance for rating data.....               | 3    |
| 5.3                                                                                      | Friedman's sum rank analysis for rank data.....         | 5    |
| 6                                                                                        | Application in sensory evaluation.....                  | 6    |
| Annex A (informative) Catalogue of incomplete block designs.....                         |                                                         | 7    |
| Annex B (informative) Example of balanced incomplete block design with ratings data..... |                                                         | 15   |
| Annex C (informative) Example of balanced incomplete block design with rank data.....    |                                                         | 17   |
| Bibliography.....                                                                        |                                                         | 19   |

## Foreword

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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 document 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](http://www.iso.org/directives)).

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This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 12, *Sensory analysis*.

This second edition cancels and replaces the first edition (ISO 29842:2011), of which it constitutes a minor revision. It also incorporates the Amendment ISO 29842:2011/Amd.1:2015.

The changes are as follows:

- the corrections of the amendment have been included;
- in [Table 2](#), the formulae in the column “Mean square” have been corrected.

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](http://www.iso.org/members.html).

# Sensory analysis — Methodology — Balanced incomplete block designs

## 1 Scope

This document specifies a method for the application of balanced incomplete block designs to sensory descriptive and hedonic tests.

This document is applicable when the number of test samples exceeds the number of evaluations that an assessor can perform reliably in a single session.

This document also specifies the fundamental characteristics of balanced incomplete block designs and establishes guidelines for their application in sensory evaluation.

## 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 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 5492, *Sensory analysis — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-1, ISO 5492 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 block design

<sensory analysis> multi-sample serving protocol in which an assessor evaluates all or a subset of the samples in a study

### 3.2 repetition

one occurrence of an experimental design

## 4 Specification of balanced incomplete block designs

Balanced incomplete block (BIB) designs apply to sensory tests in which the total number of samples is greater than the number that can be evaluated before sensory and psychological fatigue set in. In BIB designs, each assessor evaluates only a subset of the total number of samples in a single session.

An example of a BIB design is shown in [Table 1](#).

Table 1 — A BIB design with five samples and 10 block/assessors

| Block<br>(assessor) | Test sample |   |   |   |   |
|---------------------|-------------|---|---|---|---|
|                     | 1           | 2 | 3 | 4 | 5 |
| 1                   | x           | x | x | — | — |
| 2                   | x           | x | — | x | — |
| 3                   | x           | x | — | — | x |
| 4                   | x           | — | x | x | — |
| 5                   | x           | — | x | — | x |
| 6                   | x           | — | — | x | x |
| 7                   | —           | x | x | x | — |
| 8                   | —           | x | x | — | x |
| 9                   | —           | x | — | x | x |
| 10                  | —           | — | x | x | x |

In a BIB design each assessor evaluates a subset,  $k$ , of the total number of samples,  $t$ , where  $k < t$ . The subset of samples that an assessor evaluates is selected so that, in a single repetition of the BIB design, every sample is evaluated an equal number of times and all possible pairs of two samples are evaluated by an equal number of assessors.

The notation most commonly used in a BIB design is as follows:

- $t$  number of test samples;
- $k$  number of samples evaluated by an assessor in a single session ( $k < t$ );
- $b$  total number of blocks (typically, assessors) in one repetition of the BIB design;
- $r$  number of times each test sample is evaluated in one repetition of the BIB design;
- $\lambda$  number of times each pair of samples is evaluated by the same assessor;
- $p$  number of times the basic BIB design is repeated.

Notationally, each assessor evaluates  $k$  of the  $t$  samples ( $k < t$ ). The subset of  $k$  samples that an assessor evaluates is selected so that in a single repetition of the BIB design every sample is evaluated an equal number of times and all possible pairs of samples are evaluated by an equal number of assessors. The number of blocks (assessors) required to complete a single repetition of the BIB design is denoted by  $b$ . The number of times each sample is evaluated in a single repetition of the BIB design is denoted by  $r$  and the number of times every pair of two samples is evaluated together is denoted by  $\lambda$ .

The entire BIB design may need to be repeated several times in order to achieve an adequate level of precision for the study. The number of repetitions of the basic BIB design is denoted by  $p$ . The total number of blocks (typically assessors) is then  $p*b$  and the total of evaluations per sample is then  $p*r$ . The total number of times each pair of samples is seen together is  $p*\lambda$ .

The constant values of  $r$  and  $\lambda$  for all samples in the BIB design imparts important statistical properties to data collected from the design. The constant value of  $r$  ensures that the mean values of all of the samples are estimated with equal precision. The constant value of  $\lambda$  ensures that all pair-wise comparisons between any two samples are equally sensitive.

## 5 Data analysis

### 5.1 General

Two types of data can be collected using balanced incomplete block designs. Ratings data, or scores, are obtained when assessors use a scale to report the perceived intensities of the attributes or impressions they are evaluating. Rank data are obtained when assessors order the samples from lowest to highest (or vice