

BS 40102-1:2023



BSI Standards Publication

Health and well-being and indoor environmental quality in buildings

Part 1: Health and well-being in non domestic buildings –
Code of practice

bsi.

Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2023

Published by BSI Standards Limited 2023

ISBN 978 0 539 19105 9

ICS 91.040.10

The following BSI references relate to the work on this document:

Committee reference CB/401

Draft for comment 22/30443082 DC

Amendments/corrigenda issued since publication

Date

Text affected

Contents

	Page
Foreword	III
Introduction	1
1 Scope	2
2 Normative references	2
3 Terms and definitions	3
4 Assessment methodology	4
4.1 General	4
4.2 Scope assessment	4
4.3 Measurement-based assessment	5
4.4 Occupant survey	6
<i>Table 1 — Category 1: Occupant survey</i>	7
<i>Table 2 — Category 2: Visitor survey</i>	7
4.5 Analysis	7
4.6 Ongoing monitoring	7
4.7 Review process	7
5 Air	8
5.1 General	8
<i>Table 3 — Data sampling and aggregation parameters</i>	8
5.2 Particulate matter	8
<i>Table 4 — PM_{2.5}</i>	9
<i>Table 5 — PM₁₀</i>	9
5.3 Carbon monoxide	9
<i>Table 6 — Carbon monoxide (CO)</i>	10
5.4 Total volatile organic compounds	10
<i>Table 7 — Total volatile organic compounds</i>	11
5.5 Nitrogen dioxide	11
<i>Table 8 — Nitrogen dioxide</i>	12
5.6 Ozone	12
<i>Table 9 — Ozone</i>	13
5.7 Carbon dioxide	13
<i>Table 10 — Carbon dioxide</i>	13
6 Light	14
6.1 General	14
6.2 Illumination level	14
<i>Table 11 — Illumination level</i>	15
<i>Table 12 — Lighting controls</i>	15
6.3 Light source	15
6.4 Uniformity of light	16
<i>Table 13 — Uniformity of light: walls and ceilings</i>	16
<i>Table 14 — Uniformity of light: task area</i>	16
<i>Table 15 — Uniformity of light: shadowing</i>	16
6.5 Glare	17
<i>Table 16 — Glare: Field of view</i>	17
<i>Table 17 — Glare: Display screen equipment</i>	17
6.6 Flicker or light modulation	17
<i>Table 18 — Visible flicker</i>	18
<i>Table 19 — Flicker – surface/task</i>	18
<i>Table 20 — Flicker – strobing</i>	18

7	Thermal comfort	18
7.1	General	18
7.2	Naturally ventilated buildings	18
	<i>Table 21 — Air temperature</i>	19
	<i>Table 22 — Relative humidity</i>	20
7.3	Additional considerations for buildings with fan powered ventilation or air-conditioning	20
8	Acoustic and soundscape quality	20
	<i>Table 23 — Acoustic and soundscape environment</i>	21
	<i>Table 24 — Appropriateness of acoustic and soundscape environment</i>	22
9	Maintenance	22
	<i>Table 25 — Maintenance</i>	23
Annex A	(informative) Extent of scope assessment template	24
	<i>Table A.1 — Company/organizational information</i>	24
	<i>Table A.2 — Building and building services information</i>	24
	<i>Table A.3 — Maintenance regime</i>	25
Annex B	(informative) Evidence and measurement-based assessment template	25
	<i>Table B.1 — Measurement-based survey information</i>	25
	<i>Table B.2 — Zone, space, area information and measured values</i>	26
Annex C	(informative) Evaluation and scoring	28
	<i>Table C.1 — IEQ performance score levels</i>	28
	<i>Table C.2 — Air scoring matrix</i>	29
	<i>Table C.3 — Thermal comfort scoring matrix</i>	33
	<i>Table C.4 — Lighting scoring matrix</i>	34
	<i>Table C.5 — Maintenance scoring matrix</i>	35
	<i>Table C.6 — Summary score and weighting</i>	35
	<i>Table C.7 — Occupant/visitor survey weighting categories</i>	35
	<i>Table C.8 — Total Score and weighting</i>	36
Annex D	(informative) Radon and formaldehyde	37
	<i>Table D.1 — Formaldehyde</i>	38
Annex E	(informative) Occupant IEQ assessment templates	39
	<i>Table E.1 — Employee or permanent occupant survey</i>	39
	<i>Table E.2 — Visiting occupant survey</i>	45
	Bibliography	50

Summary of pages

This document comprises a front cover, an inside front cover, pages I to IV, pages 1 to 52, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 April 2023. It was prepared by Technical Committee CB/401, *Retrofitting energy efficiency measures*. A list of organizations represented on this committee can be obtained on request to the committee manager.

BSI Committee CB/401 takes collective responsibility for the preparation of this British Standard. The Committee wishes to acknowledge the contribution of EFT Consult and the members of the steering group for the development of the draft PAS 3003, which formed the basis for this standard.

Relationship with other publications

This British Standard is complementary to BS 40101, which covers the whole area of building performance evaluation.

Information about this document

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this British Standard takes the form of recommendations and guidance. It is not to be quoted as if it were a specification. Users are expected to ensure that claims of compliance are not misleading.

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient’s own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

In recent years, regulatory and commercial pressures have led designers, constructors, building owners/landlords, tenants and maintenance teams to focus on minimizing energy costs without considering that control of indoor energy sources or improving ventilation might lead to unintended consequences. This can compromise occupant mental or physical health and well-being. Environmental conditions can also be negatively impacted due to incorrect commissioning and operation of systems, leading to poor performance.

With the growing concern over the impact and cost of ill-health and pressures on public services, efforts need to be made to improve the quality of building stock to meet the well-being needs of current and future generations. In so doing, there are tangible benefits to be realized, including the following:

- a) cost savings: local or personalized control and automation of systems not only improves well-being but can enhance energy efficiency and therefore reduce operational expenditure;
- b) improved performance of occupants: increased cognitive function, productivity and reduction in fatigue, tiredness and stress;
- c) employee, tenant, customer retention and loyalty: improved indoor environmental quality (IEQ) creates an environment in which occupants feel comfortable and valued; and
- d) attraction of new staff, customers and tenants to buildings as the “location of choice”.

The building sector requires harmonized standardization of the health and well-being performance of non-domestic buildings. Therefore, this British Standard has been developed to give recommendations for the measuring, monitoring and reporting of the health and well-being factors influenced by the building and the building services. It includes a multi-layered evaluation system that generates an IEQ performance level and helps users to identify areas for improvement.

This British Standard sets out a holistic approach to the evaluation of all indoor environmental quality issues, rather than the evaluation of individual elements in isolation.

1 Scope

This British Standard gives recommendations for the measuring, monitoring and reporting of the well-being and indoor environmental quality (IEQ) performance of an occupied building and the associated building services.

This British Standard provides an evaluation and rating system, the purpose of which is to enhance IEQ, with the aim of creating buildings which support and improve the well-being of building occupants; including, but not limited to, staff, visitors, tenants and customers.

The IEQ performance score generated as an outcome of this evaluation provides organizations with a benchmark score that can be used to identify areas of below par performance and enable improvements to be made accordingly.

It is applicable to non-domestic buildings, including existing building stock. It can be used, along with other standards and design guidance, in existing buildings, renovations and new build developments for target setting, evaluation and assessment of health and well-being in buildings. It covers a good practice approach to the evaluation and assessment of the following factors:

- a) air quality;
- b) light quality;
- c) thermal comfort; and
- d) acoustic and soundscape quality.

NOTE The indoor environmental characteristics in terms of their definition, evaluation and interpretation are detailed in [BS EN 16798-1](#), [PD CEN/TR 16798-2](#) and [BS EN ISO 7730](#).

It does not cover:

- 1) spaces used for permanent or semi-permanent habitation;
- 2) temporary structures;
- 3) construction methods;
- 4) furniture, fixtures and equipment (FF&E);
- 5) health and well-being not related to the building or the building services;
- 6) medical assessment or evaluation;
- 7) cultural norms and acceptable behaviours;
- 8) life safety systems;
- 9) biophilia;
- 10) water quality; or
- 11) electro-magnetic fields.

This British Standard is for use by any organization of any size and sector. It is for use by design, construction, surveying and facilities management professionals, and also by landlords, employers, employee representatives, occupational health and safety and well-being professionals.

2 Normative references

There are no normative references in this document.¹⁾

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.