

BS 5606:2022



BSI Standards Publication

**Accuracy and tolerance in design and  
construction — Guide**

**bsi.**

Currently in preview, click buy full version

Licensed copy: Techstreet Content, ISO Exchange - Michigan, Version correct as of 27/11/2023

**Publishing and copyright information**

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

© The British Standards Institution 2022

Published by BSI Standards Limited 2022

ISBN 978 0 39 03117 1

ICS 21.240

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

Committee reference B/209

Draft for comment 21/30387674 DC

**Amendments/corrigenda issued since publication**

Date	Text affected
------	---------------

---

# Contents

	Page
<b>Foreword</b>	<b>iv</b>
<b>Section 1: General</b>	<b>1</b>
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
<b>Section 2: Challenges with accuracy and tolerance associated with the fit of elements and components of construction</b>	<b>4</b>
4 Challenges and examples	4
4.1 General	4
<i>Figure 1 — Example of dimensional variability aspects in construction of components, spaces and joints</i>	5
4.2 Strategies for the management of critical issues	5
4.3 Identification	5
4.4 Planning	6
4.5 Communication	6
4.6 Control	6
5 Digital technology considerations	6
5.1 General	6
5.2 Examples	7
<i>Figure 2 — Volumes within a tunnel design for spatial co-ordination</i>	8
6 Surveying and setting out	8
6.1 Site survey information	8
6.2 Structural elements	9
<i>Figure 3 — Example of interface tolerances between a steel beam and cladding</i>	11
6.3 Cladding and façades to external walls	11
6.4 Concrete floors	13
<i>Figure 4 — Diagrammatic section showing a sloped floor accommodating trunking and range of deviations involved</i>	14
6.5 Flat roofs	14
<i>Figure 5 — Sloped floor with tolerance expressed in gradient variation</i>	14
6.6 Lift wells	15
<i>Figure 6 — Target size of lift well</i>	16
6.7 MEP services	17
6.8 Windows, doors and paneling units	18
<i>Figure 7 — Window opening and frame to wall interface variations</i>	19
6.9 Prefabricated partitions	19
<i>Figure 8 — Example section of deflection head, standard head and sole detail</i>	20
6.10 Stairs	21
<i>Figure 9 — Staircase headroom</i>	22
6.11 Furniture and fittings	22
<i>Figure 10 — Tolerances and adjustment for aesthetic alignment of cabinet doors</i>	23
6.12 Flora elements	23
<i>Figure 11 — Calculating the tree protection zone (TPZ)</i>	24
<i>Figure 12 — Calculating the indicative structural root zone (SRZ) of uncontrolled tree roots</i>	25
<b>Section 3: Designing to achieve good fit and assembly</b>	<b>26</b>
7 Dimensional variability and target size	26
8 Spatial tolerances	26
8.1 Aims	26

8.2	Factors affecting spatial tolerances	27
8.3	Procedure for specifying spatial tolerances	27
9	Basic information and analysis of dimensional variability	27
9.1	Range of deviations associated with items of construction	27
	<i>Figure 13 — Examples of deviation limits associated with items of construction</i>	28
9.2	Range of deviations associated with manufactured components	28
	<i>Table 1 — Overall size: Length [Table C.2 (T.2.1)]</i>	29
	<i>Table 2 — Overall size: Width or height [Table C.2 (T.2.1)]</i>	30
	<i>Table 3 — Overall size: Thickness or depth [Table C.2 (T.2.1)]</i>	30
	<i>Table 4 — Overall size: Length and height to apex: Timber roof trusses</i>	30
	<i>Table 5 — Shape: Position and size of cut outs and extensions [Table C.2 (T.2.2)]</i>	31
	<i>Table 6 — Shape: Squareness [Table C.2 (T.2.2)]</i>	31
	<i>Table 7 — Shape: Internal holes [Table C.2 (T.2.2)]</i>	31
	<i>Table 8 — Connections: Position of cleats or fixing plate [Table C.2 (T.2.3)]</i>	32
	<i>Table 9 — Connections: Position of centres of bolt holes [Table C.2 (T.2.3)]</i>	32
	<i>Table 10 — Connections: Position of centres of bolt holes within welded end plates [Table C.2 (T.2.3)]</i>	33
	<i>Table 11 — Connections: Position of centres of bolt holes [Table C.2 (T.2.3)]</i>	33
9.3	Range of deviations associated with setting out and measurement processes	33
9.4	Range of deviations associated with inherent spatial deviations	34
10	Assessing the dimensional needs of a design	34
10.1	General	34
10.2	Step 1: Consideration of the dimensional variability of primary elements of construction	35
10.3	Step 2: Consideration of the dimensional variability of manufactured components	35
10.4	Step 3: Assessment of combined deviation limits	35
	<i>Figure 14 — Diagrammatic section showing total height, minimum floor to ceiling height, floor edge line and level variability, and vertical setting out variability</i>	36
	<i>Figure 15 — Minimum bearings and diaphragms</i>	37
10.5	Evaluation of design proposals	37
11	Specifying spatial tolerances	38
	<i>Figure 16 — Process flow chart for designing to achieve good fit and assembly</i>	39
	<b>Section 4: Construction considerations</b>	<b>40</b>
12	Consideration for achieving spatial tolerance in construction	40
13	Sources of induced spatial deviations	40
13.1	Induced spatial deviations in the surveying and setting out processes	40
13.2	Induced spatial deviations in manufacturing and construction	40
13.3	Induced spatial deviations in the erection and assembly process	41
13.4	Inherent spatial deviations	41
14	Control of spatial tolerances and target size	41
14.1	Monitoring	41
14.2	Dimensional control	42
14.3	Recording	42
14.4	Presentation of dimensional tolerance and accuracy data	42
14.5	Corrective action	42
14.6	Preventive action	42
<b>Annex A</b>	<b>(informative) Surveying and setting out strategy</b>	<b>44</b>
	<i>Table A.1 — Survey band accuracy table</i>	47
<b>Annex B</b>	<b>(informative) Examples of the calculations of tolerances</b>	<b>49</b>
	<i>Figure B.1 — Target sizes for a prepared opening, single window and joints</i>	51

	<i>Figure B.2 — Rebated column</i>	51
	<i>Figure B.3 — Joint cover strip</i>	51
	<i>Figure B.4 — Target sizes for a prepared opening, three windows and joints</i>	52
	<i>Figure B.5 — Variability of face line of concrete nibs</i>	53
	<i>Figure B.6 — Variability of nib in relation to brick face</i>	54
	<i>Figure B.7 — Plan showing precast cladding detail around in-situ concrete column</i>	56
	<i>Figure B.8 — Diagrammatic section of screeding</i>	57
<b>Annex C</b>	<b>(informative) Measured values of dimensional accuracy</b>	<b>57</b>
	<i>Figure C.1 — Normal distribution of sizes</i>	59
	<i>Figure C.2 — Indication of a systematic deviation of <math>+\bar{x}</math> mm from a target size</i>	60
	<i>Table C.1 — Range of deviations found achievable for construction from BRE Surveys 1975–76 and 1985–88 (98.75% confidence level)</i>	61
	<i>Table C.2 — Range of deviations achieved for manufactured components from 1985–88 BRE Survey – for information only (98.75% confidence level)</i>	67
	<i>Table C.3 — Accuracy in use of measuring instruments from BRE survey 1975–76 and 1985–88 – provided for information only</i>	69
	<i>Table C.4 — Characteristic accuracy values for construction determined from a Building Research Establishment survey from 1975 to 1976</i>	71
	<i>Table C.5 — Characteristic accuracy values for manufactured components determined from BRE survey, 1988 to 1989</i>	74
<b>Annex D</b>	<b>(informative) The BRE survey of constructed items</b>	<b>76</b>
	<i>Figure D.1 — Distance between walls or columns (from data form b)</i>	77
	<i>Figure D.2 — Distance between floor and soffit in concrete structures (from data form c)</i>	77
	<i>Figure D.3 — External dimensions of buildings and ground floor slabs (from data form d)</i>	78
	<i>Figure D.4 — Level of floor and/or soffit of concrete slab (from data form e)</i>	78
	<i>Figure D.5 — Level of soffit of concrete beams (from data form f)</i>	79
	<i>Figure D.6 — Level of top of steel beams (from data form g)</i>	79
	<i>Figure D.7 — Verticality of walls and columns, i.e. measurement procedure using a plumb-bob (from data form h)</i>	80
	<i>Figure D.8 — Depth of situ concrete beams (from data form j)</i>	80
	<i>Figure D.9 — Size and squareness of concrete columns (from data form k)</i>	81
	<i>Figure D.10 — Straightness of walls in any 5 m length (from data form l)</i>	81
	<i>Figure D.11 — Height of brick or block walls (from data form m)</i>	82
	<i>Figure D.12 — Level of bed joints of brick or block walls (from data form n)</i>	82
	<i>Figure D.13 — Thickness of brick walls (from data form o)</i>	83
	<i>Figure D.14 — Window and other openings (from data form p)</i>	83
	<b>Bibliography</b>	<b>84</b>

### Summary of pages

This document comprises a front cover, an inside front cover, pages I to VI, pages 1 to 84, 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 28 February 2022. It was prepared by Technical Committee B/209, *General building codes*. A list of organizations represented on this committee can be obtained on request to the committee manager.

## Supersession

This British Standard supersedes [BS 5606:1990](#), which is withdrawn.

## Information about this document

To aid the development of a previous edition of this standard, BSI and the Department of Environment commissioned a survey of dimensional variability on projects where tolerances had been specified. The results of the survey were analysed by the Building Research Establishment and included in that edition of the standard. This data is retained in the current edition in the tables in [Annex C](#).

This is a full revision of the standard, and introduces the following principal changes.

- The examples of issues in [Section 2](#) have been updated.
- [Section 3](#) and [Section 4](#) have been updated to include technology and process changes.
- A clear distinction has been made for the use of accuracy and tolerance as independently definable and required characteristics.
- Clarifications and caveats have been added to the BRE industry performance assessment tables from the 1970s and 1980s (in [Annex C](#)), including the importance of not relying on these for an assessment of current practice. The tables of industry performance in relation to manufacturer and assembly, and construction tolerances from the 1970s and 1980s have not been updated, but are retained for historical reference for empirical site/manufacturing performance in that period. The assumptions around dimensional variability in the industry current practice (on- or off-site) need to be assessed without reliance on the legacy tables included in this document for historical example and context.

Copyright is claimed on [Figure 2](#). Copyright holders are Mervyn Richards and Gareth Sewell.

Copyright is claimed on [Figure 8](#). Copyright holder is Etex Building Performance Limited, Gordano House, Marsfield Lane, Easton-in-Gordano, Bristol, BS20 0NE.

Copyright is claimed on [Table A.1](#). Copyright holder is the Royal Institution of Chartered Surveyors, 12 Great George Street, London, SW1P 3AD.

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](https://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 guide, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification or a code of practice.

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 guidance in this standard is presented in roman (i.e. upright) type. Any 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.*

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.**

Currently in preview, click buy full vers.

Licensed copy: Techstreet Content, ISO Exchange - Michigan, Version correct as of 27/01/2023.

---

## Section 1: General

---

### 1 Scope

This British Standard gives guidance on and provides examples of principles that relate to accuracy and tolerance in design and construction activity for the built environment. It is intended to be a practical guide to assist designers and constructors in determining and managing the risks associated with accuracy and tolerance and taking steps to control them appropriately, which, if unmanaged, can be very significant to cost, time and quality.

The fundamental objective is to provide awareness and advice on ways to avoid problems of inaccuracy or fit arising on-site. The need for such advice on any particular project varies, depending on the character of the project and the materials and methods of construction. This British Standard is designed to be relevant to all types of construction including the most sophisticated ones. Those concerned with an individual project can judge the extent to which each section is relevant to their needs.

This British Standard takes into account the growing importance of off-site construction [e.g. MMC (modern methods of construction)] and the changes in technology (e.g. digital measuring equipment) and processes [e.g. BIM (building information modelling)] since the last edition was issued. However, it also retains previous guidance where it provides essential insight and wisdom which might still be relevant today.

While this British Standard is not a guide to productivity in the construction industry, some of the impacts of accuracy and tolerance on productivity, which can be either potential improvements or lessons to be learnt, have been illustrated in [Section 2](#) by practical examples for user understanding. These are not exhaustive but are intended to highlight how these impacts can be significant, either positive or negative, and that this standard can be used as an important part of the quality planning, management and execution of design and build activity for the built environment (buildings and infrastructure).

This British Standard is designed to support the creation and implementation of a project strategy for accuracy and tolerance and provide practical implementation guidance throughout the life cycle and is supported and supported other important standards and processes. It is intended to be applied to buildings and infrastructure works in design and construction and aims to assist in the following:

- a) avoiding or resolving problems of inaccuracy or fit by assessing the dimensional needs of a design regarding tolerances, and then designing and specifying appropriately;
- b) assessing the likely achievement of tolerances in construction specified for a particular project, and giving guidance on strategies to verify capabilities and mitigate challenges;
- c) providing for monitoring and controlling work during construction to check that it is in accordance with specified dimensional tolerance and accuracy for surveys;
- d) aiding digital design and engineering (on- and off-site) including the application of BIM for the built environment; and
- e) understanding the importance of the accuracy of surveys undertaken pre, during and post construction works to measure existing features and as-built with the ability to support and verify the achievement of design tolerances and fit.