

BS 8888:2008



BSI Standards Publication

Technical product specification – Specification

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ISBN 978 0 580 60368 6

ICS 01.100.01; 01.110

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

Committee reference TDW/4

Draft for comment 08/30171388 DC

Publication history

First published August 2000

Second edition October 2002

Third edition October 2004

Fourth edition October 2006

Fifth edition November 2008

Amendments issued since publication

Amd. No.	Date	Text affected
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This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 82, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 30 November 2008. It was prepared by Technical Committee TDW/4, *Technical product specification (TPS) – Methodology, presentation and verification*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 8888:2006, which is withdrawn.

This new edition updates the fourth edition, bringing in relevant standards published during 2007 and early 2008. It does not represent a full revision of the standard, which will be undertaken in due course.

Relationship with other publications

The function of BS 8888 is to draw together, in an easily accessible manner, the full complement of International Standards relevant to the preparation of technical product specifications, in accordance with geometrical product specification (GPS) principles. However, it is not the intention that BS 8888 should be a “stand-alone” standard since it is part of a triumvirate of TPR (Technical Product Realization) standards also comprising BS 8887 and BS 8889.

It should be noted that BS 8888 has recently been taken up by the Ministry of Defence as part of its DEF-STAN for defence project specification and that BSI does make educational/training aids available in this field and is currently planning a major education/training initiative which, it is expected, will lead to a programme of competency assessment and certification.

“GPS Relevance” symbol

Because the principal objective of BS 8888 is to provide for accurate, unambiguous technical product specification (TPS), the particular standards provision that constitutes the GPS system of dimensioning and tolerancing will be found throughout the document.

Recognizing that on occasion it may be useful to be able to identify and pull together certain GPS elements into a continuous sequence, this edition of BS 8888 introduces the “GPS Relevance” symbol (see table below) as a means of doing this, for the first time. This segmented symbol is shaded to correlate with the layers of the GPS system itself and is placed in the margin adjacent to the clause or subclause to which it refers.

The formation of the symbol is based on the following. An unambiguous GPS is built upon a solid base of foundation standards relating to fundamental principles and presentation media, for example. While the specification of a feature or component defines size, geometry and surface.

Where no specific relevance to the GPS system can be identified the symbol is left unshaded.

GPS Relevance symbol

Symbol	Foundation	Size	Geometry	Surface
	No	No	No	No
	Yes	No	No	No
	No	Yes	No	No
	No	No	Yes	No
	No	No	No	Yes
	No	Yes	Yes	No
	Yes	Yes	Yes	No

Presentational conventions

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

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

All dimensions shown in the figures in this standard are in millimetres.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

1 Scope

This British Standard implements the ISO system for technical product specification.

The ISO system is defined in a large number of interlinked and related standards which are referenced from within this standard.

The purpose of this standard is to facilitate the use of the ISO system by providing:

- a) a unifying identity for the collection of ISO standards which define the ISO system for technical product specification;
- b) an index to the standards which comprise the ISO system, referencing them according to their area of application;
- c) references to additional British and European Standards where they provide information or guidance over and above that provided by ISO standards; and
- d) commentary and recommendations on the application of the standards where this is deemed useful.

The requirements refer to International and European Standards which have been implemented as British Standards either in the BS ISO, BS EN, BS EN ISO series or as International Standards re-numbered as British Standards.

Annex A and Annex B list cross-referenced standards and other documents, normative and informative respectively, by primary reference.

Annex C (informative) gives guidance on the expression of conceptual design intent.

Annex D (informative) provides guidance on standards for cast, forged and moulded parts.

Annex E (normative) sets out requirements for enhanced document security.

Annex F (informative) identifies the main differences in approach between the provisions of this standard and those of the American Society of Mechanical Engineers (ASME) Y14.5:1994.

Annex G (informative) provides a brief history of the development of BS ISO 1101.

Annex H (informative) provides a summary report on the concepts that have underwritten the development of technical product specification (TPS) and its primary constituent, geometrical product specification (GPS), to date and discusses some of the drivers for future change.

NOTE 1 This is the paper-based version of BS 8888, which will henceforth be kept live and updated online. TPS Online, including BS 8888, can be found at <http://www.bsigroup.com/bs8888>, accompanied by the full range of cross-referenced standards, all hyperlinked to the relevant reference(s) within the text of the primary standard. When used in paper form, it is necessary that this standard be used in conjunction with the relevant cross-referenced standards.

NOTE 2 This British Standard is also available in CD-ROM format.



2 References

NOTE References to other standards are categorized as normative or informative.

2.1 Normative references

The normative documents listed in Annex A are indispensable for the application 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.

Conformity to normative references forms an integral part of conformity to this standard. Where any part of a TPS claims to conform to BS 8888, it has to satisfy the requirements of any of the normative references that apply to its content.

2.2 Informative references

There is no requirement to conform to informative references; these are references to other publications that provide information or guidance only. References to informative documents are shown in the body of the standard in italicized text, and they are also listed in Annex B.

Care should be taken to ensure that reference is made to the most recent edition.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply, together with those given in:

- | | |
|-------------------|--|
| BS ISO 10209-1 | <i>Technical product documentation – Vocabulary – Part 1: Terms relating to technical drawings: general and types of drawing</i> |
| BS EN ISO 10209-2 | <i>Technical product documentation – Vocabulary – Part 2: Terms relating to projection methods</i> |
| BS EN ISO 14660-1 | <i>Geometrical product specification (GPS) – Geometrical features – Part 1: General terms and definitions</i> |

3.1 date of acceptance

point in time at which all interested parties agree that the technical product specification is to be considered finalized to the extent that manufacturing can commence

NOTE 1 This may be identified by other terms, e.g. “date of issue”.

NOTE 2 For the implications of the date of acceptance see 4.2.4.

3.2 geometrical product specification GPS

ISO system for defining the shape (geometry), dimensions and surface characteristics of a workpiece



3.3 technical product document TPD

means of conveying all or part of a design definition or specification of a product

3.4 technical product specification TPS

collection of technical product documents comprising the complete design definition and specification of a product

NOTE 1 A TPS was previously called a technical product document set.

NOTE 2 A TPS can consist of one or more TPDs.

NOTE 3 A TPS will contain GPS application (see 15.1.1 for first reference).

4 Global standards underpinning BS 8888

4.1 Introduction

The ISO Geometrical Product Specification (GPS) Standards Matrix embodies the concept of “global” standards that underpin the whole GPS process. This principle is adopted in BS 8888 and the following standards shall be applied as “global” standards in support of BS 8888.

BS EN ISO 1	<i>Geometrical Product Specifications (GPS) – Standard reference temperature for geometrical product specification and verification</i>
BS ISO 10579	<i>Technical drawings – Dimensioning and tolerancing – Non-rigid parts</i>
BS EN ISO 14253-1	<i>Geometrical product specifications (GPS) – Inspection by measurement of workpieces and measuring equipment – Part 1: Decision rules for proving conformance or non-conformance with specifications</i>
BS EN ISO 14253-2	<i>Geometrical product specifications (GPS) – Inspection by measurement of workpieces and measuring equipment – Part 2: Guide to the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification</i>
DD ISO/TS 17450-1	<i>Geometrical product specification (GPS) – Part 1: Model for geometrical specification and verification</i>
DD ISO/TS 17450-2	<i>Geometrical product specification (GPS) – Part 2: Operators and uncertainties</i>
PD 6461-1	<i>General metrology – Part 1: Basic and general terms (VIM)</i>
PD 6461-3	<i>General metrology – Part 3: Guide to the expression of uncertainty in measurement (GUM)</i>



4.2 The fundamental TPS principles

4.2.1 Introduction

The following principles shall always be applied where compliance with BS 8888 is claimed.

4.2.2 General principles of specification

A TPS shall document the criteria that the manufactured product has to satisfy.

NOTE 1 The TPS may include requirements of individual manufactured components, where necessary.

NOTE 2 The TPS may include additional information required for the manufacture, verification, maintenance and disposal of the product.

NOTE 3 Criteria may include requirements relating to the appearance, transportation, storage, maintenance, assembly, disassembly, recycling and disposal of the product, as well as its performance and reliability in use.

Sizes, geometrical relationships and tolerances which are necessary for the correct functioning or location of a component or assembly shall be specified through the use of datums, dimensions and tolerances.

NOTE 4 Selection of datum features which are not related to the function or location of a component or assembly results in the need for tighter tolerances.

A TPS shall provide sufficient information to avoid ambiguity of interpretation.

NOTE 5 A TPS is not complete if there is more than one possible interpretation of the specification.

A TPS shall provide sufficient information for the product to be manufactured, but shall not unnecessarily constrain manufacturing methods.

NOTE 6 A particular manufacturing process which has been tested and approved for the production of a safety-critical component would be an example of a situation where there is a requirement to specify the manufacturing method.

A TPS shall provide sufficient information for the verification of each element of the specification, but shall not unnecessarily constrain verification methods.

NOTE 7 A technical product specification should provide all the information necessary for the manufacture and verification of the product, or state where that information can be found. This may be achieved through the use of notes and references to other standards or documents.

4.2.3 The acceptance date principle

What is not specified in a TPS at the date of acceptance cannot be required.

A TPS shall always be interpreted according to those versions of standards which governed its interpretation on its acceptance date.

4.2.4 The reference condition principle

Unless otherwise stated, all geometrical forms, sizes and tolerances for a work-piece given in a TPS are considered to apply at 20 °C (see BS EN ISO 1).

Unless otherwise stated, all geometrical sizes, forms and tolerances for a work-piece given in a TPS are considered to apply in the absence of any external forces (including gravity).

NOTE When aligning and/or measuring large and/or flexible constructions, this is of particular importance.

4.3 Implied annotation

The following rules govern the use and interpretation of implied annotation on engineering drawings.

A dimension may be implied and not indicated on a drawing in the following circumstances, so long as there is no risk of misinterpretation:

- a) where two features are aligned, there is no requirement to indicate a linear dimension of 0 or an angular dimension of 0°;
- b) where two features are parallel to each other, there is no requirement to indicate an angular dimension of 0° or 180°;
- c) where two features are at 90° to each other, there is no requirement to indicate an angular dimension of 90°;
- d) where several features are equispaced around a pitch circle (see BS ISO 129-1), there is no requirement to indicate an angular dimension, although it may be advisable to do so;
- e) where not otherwise indicated, holes are considered as through holes.

If the features concerned have their locations and/or orientations controlled through the use of geometrical tolerances, then the implied dimensions shall be taken as Theoretically Exact Dimensions (TEDs; see BS ISO 1101).

If the features concerned have their locations and/or orientations controlled through the use of +/- or limit tolerances, then the implied dimensions shall also be toleranced. In the absence of other indications, they shall be subject to a general tolerance, or else the TPS would remain incomplete.

Tolerances shall never be implied, and shall always be indicated.

Datums shall never be implied, and shall always be indicated.

COMMENTARY ON CLAUSE 4

Guidance on the expression of conceptual design intent is given in Annex C.

5 Types of documentation

5.1 General

The careful targeting of TPDs to known or intended users will greatly assist the accuracy with which the specification is converted into the final product. While precision and avoidance of ambiguity should always be paramount, the means employed to convey this information



should always be seen to match the capability, or potential capability, of the available or achievable manufacturing facility. Specification beyond this level is unlikely to produce satisfactory results and will often prove expensive, both in terms of the cost of the over-specification itself and in terms of inadequate or unacceptable product.

5.2 Presentation media

5.2.1 General

The presentation of the drawings shall conform to the following standards.

BS EN ISO 5457	<i>Technical product documentation – Sizes and layout of drawing sheets</i>
BS EN ISO 7200:2004	<i>Technical product documentation – Data fields in title blocks and document headers</i>
BS ISO 7573	<i>Technical drawings – Item lists</i>

5.2.2 Format

Drawing sheets and other documents shall be presented in one of the following formats:

- a) landscape: intended to be viewed with the longest side of the sheet horizontal;
- b) portrait: intended to be viewed with the longest side of the sheet vertical.

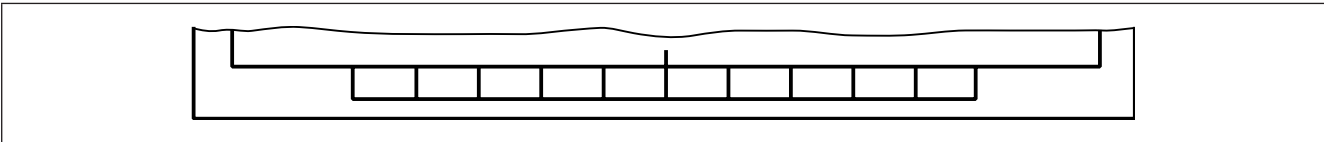
NOTE Contrary to BS EN ISO 5457, A4 sheets may be used in landscape or portrait mode.

5.2.3 Metric reference graduation

COMMENTARY AND RECOMMENDATIONS

Any metric reference graduation (scale bar) should be figure-less, have a minimum length of 100 mm and be graduated at 10 mm intervals. It should be located symmetrically about a centring mark, near the frame and within the border. It should have a maximum width of 5 mm and the continuous strokes should be of 0.5 mm maximum thickness (see Figure 1).

Figure 1 Metric reference graduations



5.3 Combined drawing

COMMENTARY AND RECOMMENDATIONS

A combined drawing should display an assembly, item list and constituent details, drawn separately but all on the same drawing.





5.4 Diagram

COMMENTARY AND RECOMMENDATIONS

The function of a system, or the relationship between component parts, may be depicted in a diagram employing simplified representations, as recommended in the following standards.

- BS EN ISO 3952-1 *Kinematic diagrams – Graphical symbols – Part 1*
- BS EN ISO 3952-2 *Kinematic diagrams – Graphical symbols – Part 2*
- BS EN ISO 3952-3 *Kinematic diagrams – Graphical symbols – Part 3*
- BS EN ISO 3952-4 *Technical drawings – Simplified representation for kinematics – Part 4: Miscellaneous mechanisms and their components*

- BS 5070-1 *Engineering diagram drawing practice – Part 1: Recommendations for general principles*
- BS 5070-3 *Engineering diagram drawing practice – Part 3: Recommendations for mechanical/fluid flow diagrams*
- BS 5070-4 *Engineering diagram drawing practice – Part 4: Recommendations for logic diagrams*
- BS EN 61082-2 *Preparation of documents used in electrotechnology – Part 2: Function-oriented diagrams*

5.5 Document list – Drawing list

COMMENTARY AND RECOMMENDATIONS

A document list should consist of a list of all graphical representations and selected specifications required to build the assembly from which it derives its title and primary identifier.

6 Scales

Scales shall conform to the following standard.

- BS EN ISO 5455 *Technical drawings – Scales*

7 Lines, arrows and terminators

7.1 Lines and terminators

Lines shall conform to the following standards, as appropriate.

- BS EN ISO 128-20 *Technical drawings – General principles of presentation – Part 20: Basic conventions for lines*
- BS EN ISO 128-21 *Technical drawings – General principles of presentation – Part 21: Preparation of lines by CAD systems*
- BS ISO 128-22 *Technical drawings – General principles of presentation – Part 22: Basic conventions and applications for leader lines and reference lines*
- BS ISO 128-23 *Technical drawings – General principles of presentation – Part 23: Lines on construction drawings*



- | | |
|---------------|--|
| BS ISO 128-24 | <i>Technical drawings – General principles of presentation – Part 24: Lines on mechanical engineering drawings</i> |
| BS ISO 128-25 | <i>Technical drawings – General principles of presentation – Part 25: Lines on shipbuilding drawings</i> |

7.2 Lines, terminators and origin indicators

Arrows and terminators composed of lines shall conform to the following standard.

- | | |
|--------------|---|
| BS ISO 129-1 | <i>Technical drawings – Indications of dimensions and tolerances – Part 1: General principles</i> |
|--------------|---|

8 Lettering

8.1 General

Lettering shall conform to the following standard.

- | | |
|------------------|---|
| BS EN ISO 3098-0 | <i>Technical product documentation – Lettering – Part 0: General requirements</i> |
|------------------|---|

Lettering shall also conform to the following standards, as appropriate.

- | | |
|------------------|--|
| BS EN ISO 3098-2 | <i>Technical product documentation – Lettering – Part 2: Latin alphabet, numerals and marks</i> |
| BS EN ISO 3098-3 | <i>Technical product documentation – Lettering – Part 3: Greek alphabet</i> |
| BS EN ISO 3098-4 | <i>Technical product documentation – Lettering – Part 4: Diacritical and particular marks for the Latin alphabet</i> |
| BS EN ISO 3098-5 | <i>Technical product documentation – Lettering – Part 5: CAD lettering of the Latin alphabet, numerals and marks</i> |
| BS EN ISO 3098-6 | <i>Technical product documentation – Lettering – Part 6: Cyrillic alphabet</i> |

8.2 Notes

When a landscape-format drawing sheet is used in its normal orientation, with the title block at the bottom right-hand corner, notes shall be lettered parallel to the long side of the sheet. When a landscape-format drawing sheet is used in portrait orientation, the title block shall be located at the left-hand side and notes shall be lettered parallel to the short side of the sheet.



COMMENTARY AND RECOMMENDATIONS ON 8.2

Placement

Notes of a general nature should, wherever practicable, be grouped together and not distributed over the drawing. Notes relating to specific details should appear near the relevant feature, but not so near as to crowd the view.

Underlining

Underlining of notes is not recommended. Where emphasis is required, larger characters should be used.

Lettering

It is recommended that capital lettering is used wherever possible.

9 Projections

Projections shall conform to one of the following standards:

BS EN ISO 5456-2 *Technical drawings – Projection methods – Part 2: Orthographic representations*

BS EN ISO 5456-3 *Technical drawings – Projection methods – Part 3: Axonometric representations*

BS ISO 5456-4 *Technical drawings – Projection methods – Part 4: Central projection*

BS EN ISO 10209-2 *Technical product documentation – Vocabulary – Part 2: Terms relating to projection methods*

NOTE BS EN ISO 5456-1, Technical drawing – Projection methods – Part 1: Synopsis, contains a survey of the various projection methods.

10 Views

10.1 General

Views shall conform to the following standards.

BS ISO 128-30 *Technical drawings – General principles of presentation – Part 30: Basic conventions for views*

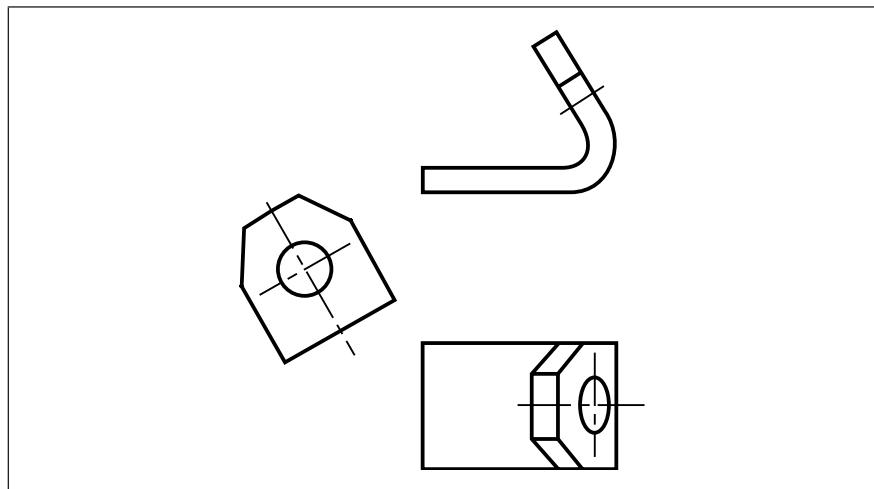
BS ISO 128-34 *Technical drawings – General principles of presentation – Part 34: Views on mechanical engineering drawings*

10.2 Auxiliary views

Where true representation of features is necessary, but cannot be achieved on the orthographic views, the features shall be shown in projected auxiliary views. An example is shown in Figure 2.



Figure 2 Auxiliary view showing true shape of inclined surface



11 Sections

Sections shall conform to the following standards.

- | | |
|---------------|---|
| BS ISO 128-40 | <i>Technical drawings – General principles of presentation – Part 40: Basic conventions for cuts and sections</i> |
| BS ISO 128-44 | <i>Technical drawings – General principles of presentation – Part 44: Sections on mechanical engineering drawings</i> |
| BS ISO 128-50 | <i>Technical drawings – General principles of presentation – Part 50: Basic conventions for representing areas on cuts and sections</i> |

NOTE ISO 128-44 and ISO 128-50 contained presentational defects in some figures (e.g. line types, line thickness, terminators and letter heights), which have, unavoidably, been carried forward to the BS implementations. It is stressed that the text of these standards is technically correct and users should, therefore, regard the figures as illustrations only.

12 Symbols and abbreviations

12.1 General

- 12.1.1** Abbreviations (text equivalents) shall be the same in the singular and plural. Full stops shall not be used except where the abbreviation forms a word (e.g. NO. as an abbreviation for “number”).
- 12.1.2** Symbols used for physical quantities and units of measurement shall conform to the following standards, as appropriate.

- | | |
|-------------|---|
| BS ISO 31-0 | <i>Specification for quantities, units and symbols – Part 0: General principles</i> |
| BS ISO 31-1 | <i>Specification for quantities, units and symbols – Part 1: Space and time</i> |
| BS ISO 31-2 | <i>Specification for quantities, units and symbols – Part 2: Periodic and related phenomena</i> |



BS ISO 31-3	<i>Specification for quantities, units and symbols – Part 3: Mechanics</i>
BS ISO 31-4	<i>Specification for quantities, units and symbols – Part 4: Heat</i>
BS ISO 31-5	<i>Specification for quantities, units and symbols – Part 5: Electricity and magnetism</i>
BS ISO 31-6	<i>Specification for quantities, units and symbols – Part 6: Light and related electromagnetic radiations</i>
BS ISO 31-7	<i>Specification for quantities, units and symbols – Part 7: Acoustics</i>
BS ISO 31-8	<i>Specification for quantities, units and symbols – Part 8: Physical chemistry and molecular physics</i>
BS ISO 31-9	<i>Specification for quantities, units and symbols – Part 9: Atomic and nuclear physics</i>
BS ISO 31-10	<i>Specification for quantities, units and symbols – Part 10: Nuclear reactions and ionizing radiations</i>
BS ISO 31-11	<i>Specification for quantities, units and symbols – Part 11: Mathematical signs and symbols for use in physical sciences and technology</i>
BS ISO 31-12	<i>Specification for quantities, units and symbols – Part 12: Characteristic numbers</i>
BS ISO 31-13	<i>Specification for quantities, units and symbols – Part 13: Solid state physics</i>
BS ISO 1000	<i>Specification for SI Units and recommendations for the use of their multiples and of certain other units</i>

12.2 Standard symbols and abbreviations

Symbols appropriate to technical product specification are provided and detailed throughout the suite of documents cross referenced from this standard and these shall be used where appropriate.

NOTE 1 It is strongly recommended that abbreviations not be used.

Where, in particular technical fields, certain abbreviations are in common use and generally understood, it is accepted that these may continue to be used but new abbreviations shall not be introduced.

NOTE 2 Former practice has resulted in certain abbreviations becoming accepted as symbols and these should not be considered to provide precedence for the proliferation of abbreviations.

COMMENTARY AND RECOMMENDATIONS ON CLAUSE 12

In the existing environment of outsourcing across national borders, every effort is being made to make the use of GPS, independent of language through the adoption of standard symbology. It is for this reason that the continued use of abbreviations is deprecated. Where particular specification requirements cannot be expressed using the available GPS system, full text description should be employed. It is suggested that where such a requirement occurs frequently, this be drawn to the attention of the relevant ISO committee through the appropriate BSI Technical Committee.



For diagrams used in technical applications, a library of harmonized graphical symbols has been developed with close cooperation between ISO and IEC. This is published in the following series of standards and it is recommended that they be applied wherever practicable to improve the universal applicability of the TPS.

BS ISO 14617-1	<i>Graphical symbols for diagrams – Part 1: General information and indexes</i>
BS ISO 14617-2	<i>Graphical symbols for diagrams – Part 2: Symbols having general application</i>
BS ISO 14617-3	<i>Graphical symbols for diagrams – Part 3: Connections and related devices</i>
BS ISO 14617-4	<i>Graphical symbols for diagrams – Part 4: Actuators and related devices</i>
BS ISO 14617-5	<i>Graphical symbols for diagrams – Part 5: Measurement and control devices</i>
BS ISO 14617-6	<i>Graphical symbols for diagrams – Part 6: Measurement and control functions</i>
BS ISO 14617-7	<i>Graphical symbols for diagrams – Part 7: Basic mechanical components</i>
BS ISO 14617-8	<i>Graphical symbols for diagrams – Part 8: Valves and dampers</i>
BS ISO 14617-9	<i>Graphical symbols for diagrams – Part 9: Pumps, compressors and fans</i>
BS ISO 14617-10	<i>Graphical symbols for diagrams – Part 10: Fluid power converters</i>
BS ISO 14617-11	<i>Graphical symbols for diagrams – Part 11: Devices for heat transfer and heat engines</i>
BS ISO 14617-12	<i>Graphical symbols for diagrams – Part 12: Devices for separating, purification and mixing</i>

13 Representation of features

Conventions used for the representation of features shall conform to the following standards, as appropriate.

BS EN ISO 4063	<i>Welding and allied processes – Nomenclature of processes and reference numbers</i>
BS EN ISO 5261	<i>Technical drawings – Simplified representation of bars and profile sections</i>
BS EN ISO 5845-1	<i>Technical drawings – Simplified representation of the assembly of parts with fasteners – Part 1: General principles</i>
BS EN ISO 6410-1	<i>Technical drawings – Screw threads and threaded parts – Part 1: General conventions</i>
BS EN ISO 6410-2	<i>Technical drawings – Screw threads and threaded parts – Part 2: Screw thread inserts</i>
BS EN ISO 6410-3	<i>Technical drawings – Screw threads and threaded parts – Part 3: Simplified representation</i>
BS EN ISO 6411	<i>Technical drawings – Simplified representation of centre holes</i>



BS EN ISO 6413	<i>Technical drawings – Representation of splines and serrations</i>
BS ISO 13715	<i>Technical drawings – Edges of unidentified shape – Vocabulary and indications</i>
BS EN ISO 15785	<i>Technical drawings – Symbolic presentation and indication of adhesive, fold and pressed joints</i>
BS EN 22553	<i>Welded, brazed and soldered joints – Symbolic representation on drawings</i>

NOTE The BS ISO 128 series of standards covers the general subject of feature representation.

14 Representation of components

14.1 General



Conventions used for the representation of components shall conform to the following standards, as appropriate.

BS EN ISO 2162-1	<i>Technical product documentation – Springs – Part 1: Simplified representation</i>
BS EN ISO 2162-2	<i>Technical product documentation – Springs – Part 2: Presentation of data for cylindrical helical compression springs</i>
BS EN ISO 2162-3	<i>Technical product documentation – Springs – Part 3: Vocabulary</i>
BS EN ISO 2203	<i>Technical drawings – Conventional representation of gears</i>
BS 2917-1	<i>Graphic symbols and circuit diagrams for fluid power systems and components – Part 1: Specification for graphic symbols</i>
BS 3238-1	<i>Graphical symbols for components of servo-mechanisms – Part 1: Transducers and magnetic amplifiers</i>
BS 3238-2	<i>Graphical symbols for components of servo-mechanisms – Part 2: General servo-mechanisms</i>
BS EN ISO 5845-1	<i>Technical drawings – Simplified representation of the assembly of parts with fasteners – Part 1: General principles</i>
BS EN ISO 6410-1	<i>Technical drawings – Screw threads and threaded parts – Part 1: General conventions</i>
BS EN ISO 6410-2	<i>Technical drawings – Screw threads and threaded parts – Part 2: Screw thread inserts</i>
BS EN ISO 6410-3	<i>Technical drawings – Screw threads and threaded parts – Part 3: Simplified representation</i>
BS EN ISO 6412-1	<i>Technical drawings – Simplified representation of pipelines – General rules and orthogonal representation</i>
BS EN ISO 6412-2	<i>Technical drawings – Simplified representation of pipelines – Isometric projection</i>

- BS EN ISO 6412-3 *Technical drawings – Simplified representation of pipelines – Terminal features of ventilation and drainage systems*
- BS EN ISO 8826-1 *Technical drawings – Roller bearings – Part 1: General simplified representation*
- BS EN ISO 8826-2 *Technical drawings – Roller bearings – Part 2: Detailed simplified representation*
- BS EN ISO 9222-1 *Technical drawings – Seals for dynamic application – Part 1: General simplified representation*
- BS EN ISO 9222-2 *Technical drawings – Seals for dynamic application – Part 2: Detailed simplified representation*

NOTE The BS ISO 128 series of standards covers the general subject of component representation.

14.2 Representation of moulded, cast and forged components

Dimensional tolerancing for metal and metal alloy castings shall conform to the following standards, as appropriate.

- BS ISO 10135 *Geometrical product specifications (GPS) – Drawing indications for moulded parts in technical product documentation (TPD)*
- BS EN ISO 8062-1 *GPS – Dimensional and geometrical tolerances for moulded parts – Vocabulary*
- BS EN ISO 8062-3 *GPS – Dimensional and geometrical tolerances for moulded parts – General dimensional and geometrical tolerances and machine allowances for casting*

COMMENTARY AND RECOMMENDATIONS ON 14.2

It is recommended that tolerances for the dimensions of plastics mouldings be applied in accordance with the system provided in BS 7010.

Annex D provides guidance on standards for cast, forged and moulded parts.

15 Dimensioning and tolerancing

15.1 Interpretations of limits of size for a feature-of-size

15.1.1 General

Limits of size for an individual feature-of-size shall be interpreted according to the principles and rules defined in BS ISO 8015, BS EN ISO 14660-1 and BS EN ISO 14660-2.

- BS ISO 8015 *Technical drawings – Fundamental tolerancing principle*
- BS EN ISO 14660-1 *Geometrical Product Specifications (GPS) – Geometrical features – Part 1: General terms and definitions*



BS EN ISO 14660-2 *Geometrical Product Specifications (GPS) – Geometrical features – Part 2: Extracted median line of a cylinder and a cone, extracted median surface, local size of an extracted feature.*

COMMENTARY ON 15.1.1

A feature-of-size may consist of two parallel plane surfaces, a cylindrical surface or a spherical surface, in each case defined with a linear size. A feature-of-size may also consist of two plane surfaces at an angle to each other (a wedge) or a conical surface, in each case defined with an angular size.

BS ISO 8015 states that limits of size control only the actual local sizes (two-point measurements) of a feature-of-size, and not its deviations of form (e.g. the roundness and straightness deviations of a cylindrical feature, or the flatness deviations of two parallel plane surfaces). Form deviations may be controlled by individually specified geometrical tolerances, general geometrical tolerances or through the use of the Envelope Requirement (where the maximum material limit of size defines an envelope of perfect form for the relevant surfaces; see BS ISO 8015).

BS ISO 8015 defines the Principle of Independency, according to which each specified dimensional and geometrical requirement on a drawing is met independently, unless a particular relationship is specified. A relationship may be specified through the use of the Envelope Requirement or material condition modifiers (MMC or LMC).

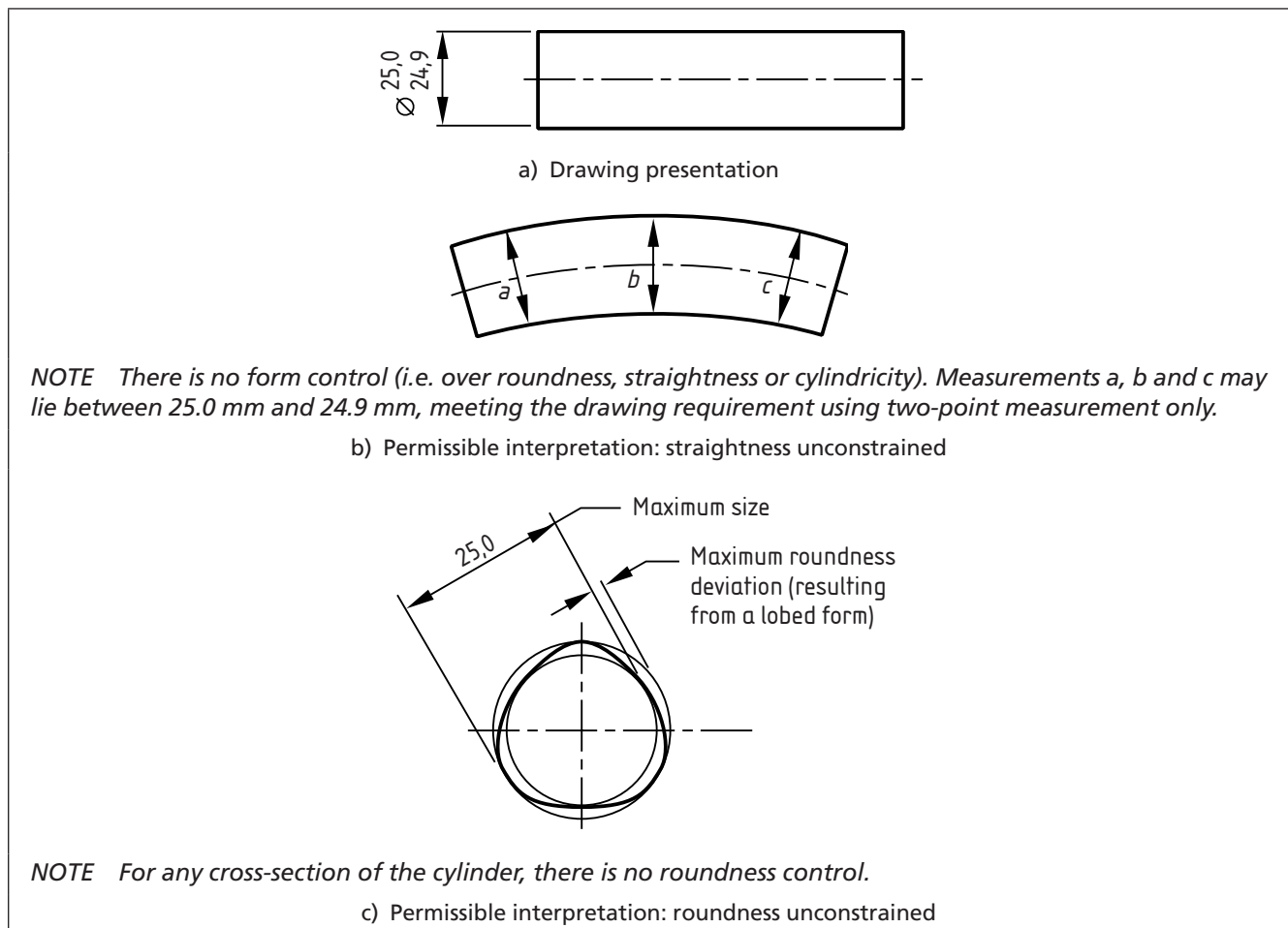
Where no relationship is specified, any geometrical tolerance applied to the feature-of-size applies regardless of feature size, and the two requirements are treated as unrelated (see Figure 3). The limits of size do not control the form, orientation, or the spatial relationship between, individual features-of-size.

Consequently, if a particular relationship of:

- size and form; or*
- size and location; or*
- size and orientation;*

is required, it needs to be specified.

Figure 3 Permissible interpretations when no form control is given on the drawing



15.1.2 Limits of size with mutual dependency of size and form

COMMENTARY AND RECOMMENDATIONS ON 15.1.2

Some national standards apply, or have applied, the Envelope Requirement to all features-of-size by default. As the Envelope Requirement has been the default, they have not used a symbol to indicate this requirement; rather they use a note to indicate when this is not required. This system of tolerancing is sometimes described as the Principle of Dependency, or the application of the Taylor Principle.

Standards which apply, or have applied, the Envelope Requirement by default include:

ASME Y14.5 (the requirement that there is an envelope of perfect form corresponding to the Maximum Material Size of the feature is defined as Rule #1).

BS 308 (the Principle of Dependency was taken as the default option under BS 308, although the option of working to the Principle of Independency was included, through the use of the BS 308 triangle I indication):



BS 8888 prior to the 2004 revision (the Principle of Dependency was taken as the default option under BS 8888:2000 and BS 8888:2002, although the option of working to the Principle of Independency was included, through the use of the BS 8888 triangle I indication).

BS 8888:2004 and BS 8888:2006 (the Principle of Dependency could be explicitly invoked through the use of the BS 8888 triangle D indication):



As the interaction between the Envelope Requirement and individual geometrical tolerances is not always fully defined within the ISO system, and as the application of the Envelope Requirement by default to all features-of-size is not formally supported within the ISO system (except through the use of ISO 2768-2, the use of which is in any case inadvisable) the use of the Principle of Dependency is no longer recommended.

15.2 General

Dimensioning and tolerancing shall conform to the following standards, as appropriate:

BS ISO 129-1	<i>Technical drawings – Indications of dimensions and tolerances – Part 1: General principles</i>
BS ISO 406	<i>Technical drawings – Tolerancing of linear and angular dimensions</i>
BS EN ISO 1119	<i>Geometrical product specifications (GPS) – Series of conical tapers and taper angles</i>
BS EN ISO 1660	<i>Technical drawings – Dimensioning and tolerancing of profiles</i>
BS 1916-1	<i>Limits and fits for engineering – Part 1: Limits and tolerances</i>
BS 1916-2	<i>Limits and fits for engineering – Part 2: Guide to the selection of fits in BS 1916:Part 1</i>
BS 1916-3	<i>Limits and fits for engineering – Part 3: Recommendations for tolerances, limits and fits for large diameters</i>
BS ISO 3040	<i>Technical drawings – Dimensioning and tolerancing – Cones</i>
BS 4500-4	<i>ISO limits and fits – Specification for system of cone (taper) fits for cones from C=1:3 to 1:500, lengths from 6 mm to 630 mm and diameters up to 500 mm</i>
BS 4500-5	<i>ISO limits and fits – Specification for system of cone tolerances for conical workpieces from C = 1:3 to 1:500 and lengths from 6 mm to 630 mm</i>
BS EN ISO 5458	<i>Geometrical Product Specifications (GPS) – Geometrical tolerancing – Positional tolerancing</i>
BS EN ISO 6410-1	<i>Technical drawings – Screw threads and threaded parts – Part 1: General conventions</i>
BS 6615	<i>Specification for dimensional tolerances for metal and metal alloy castings</i>
BS 7010	<i>Code of practice for a system of tolerances for the dimensions of plastic mouldings</i>
BS EN ISO 7083	<i>Technical drawings – Symbols for geometrical tolerancing – Proportions and dimensions</i>
BS ISO 8015	<i>Technical drawings – Fundamental tolerancing principle</i>



BS ISO 10579	<i>Technical drawings – Dimensioning and tolerancing – Non-rigid parts.</i>
BS ISO 13920	<i>Welding – General tolerances for welded constructions – Dimensions for lengths and angles – Shape and position.</i>
BS EN 20286-1	<i>ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits.</i>
BS EN 20286-2	<i>ISO system of limits and fits – Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.</i>

COMMENTARY AND RECOMMENDATIONS ON 15.2

Gaps between extension lines and features.

It is the practice in the UK to leave a small gap between the extension line and the feature. In BS ISO 129-1 the illustrated examples do not show a gap but 5.3, includes the text, “in certain technical fields, a gap between the feature and the beginning of the extension line is acceptable”. The UK has always held to the view that for reasons of clarity a gap is preferable and given that in the revised standard the gap is permissible, it is intended that the current UK practice should be maintained.

15.3 Presentation of decimals

15.3.1 Decimal marker

The decimal marker shall be a comma.

15.3.2 Non-indicated decimals in tolerances

Non-indicated decimals in a tolerance indication shall be taken as zeros e.g. 0,2 is the same as 0,2000000000....

COMMENTARY AND RECOMMENDATIONS ON 16.3

It is recommended that each group of three digits, counting from the decimal marker to the left and to the right, be separated from other digits by a small space (e.g. 12 345,067 8). In view of the requirement of 15.3.1, the use of a comma or a point for this purpose is deprecated, i.e. it is further recommended that separation of items in lists be effected by the use of a semi-colon. (See BS ISO 31-0 Specification for quantities, units and symbols – Part 0: General principles.)

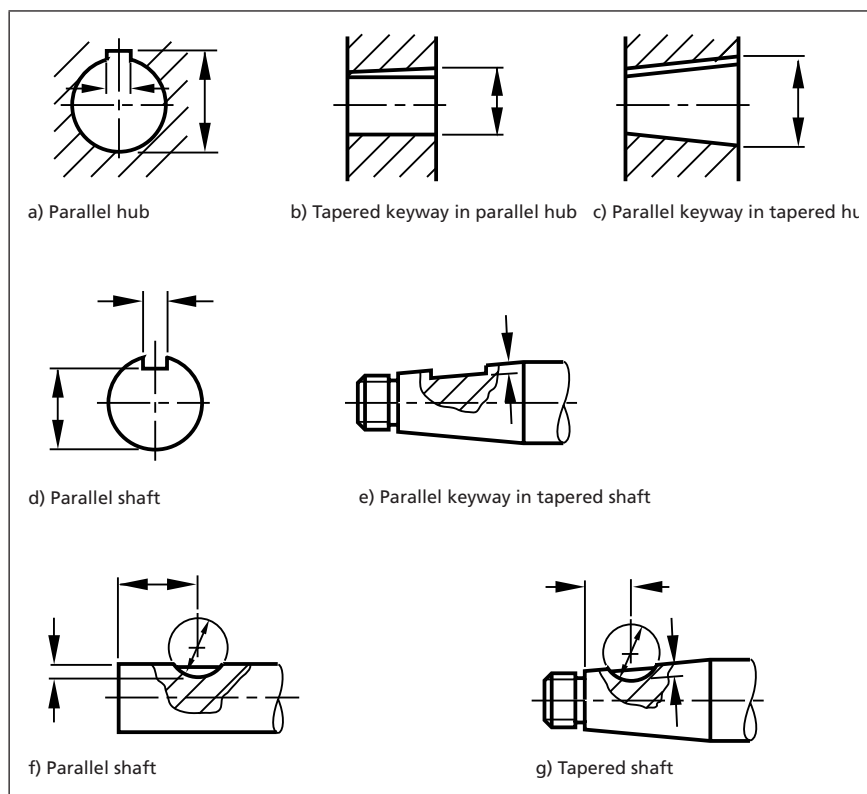
15.4 Keyways

Keyways in hubs or shafts shall be dimensioned by one of the methods shown in Figure 4.

NOTE Further information on keys and keyways is given in BS 4235-1, Specification for metric keys and keyways – Part 1: Parallel and taper keys, and BS 4235-2, Specification for metric keys and keyways – Part 2: Woodruff keys and keyways.



Figure 4 Dimensioning of keyways



15.5 Screw threads

Screw threads shall be specified according to functional requirement.

COMMENTARY AND RECOMMENDATIONS ON 15.5

The following standards provide the definition for metric ISO screw threads.

BS 3643-1 ISO metric screw threads – Part 1: Principles and basic data

BS 3643-2 ISO metric screw threads – Part 2: Specification for selected limits of size

BS 4827 Specification for ISO miniature screw threads – Metric series

BS ISO 261 ISO general purpose metric screw threads – General plan

BS ISO 262 ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts

BS ISO 965-1 ISO general purpose metric screw threads – Tolerances – Part 1: Principles and basic data.

15.6 Methods of specifying tolerances

COMMENTARY AND RECOMMENDATIONS ON 15.6

The necessary tolerances can be specified in one or more of the following ways:

- separate indication on the drawing;
- reference to general tolerances noted on the drawing;
- reference to a standard containing general tolerances;
- reference to other documents.

15.7 General tolerancing

COMMENTARY AND RECOMMENDATIONS ON 15.7

If reference to BS EN 22768-1 or BS EN 22768-2 for general tolerances is inappropriate, general tolerance notes may be used to apply a common tolerance to many of the features on a drawing. The example shown in Figure 5 illustrates the wide field of application of this system.

Due to the inherent risk of unintentionally over-specifying form and orientation controls that can result from the use of general geometrical tolerances, reference to BS EN 22768-2 is inadvisable.

Figure 5 Examples of general tolerance notes

TOLERANCE EXCEPT WHERE OTHERWISE STATED $\pm X$	TOLERANCES EXCEPT WHERE OTHERWISE STATED		
	SIZE	TOLERANCE	
	- UP TO X	$\pm A$	
	OVER X UP TO XX	$\pm B$	
	OVER XX UP TO XXX	$\pm C$	
	OVER XXX -	$\pm D$	
	ON ANGLES	$\pm E$	
TOLERANCE ON CAST THICKNESS $\pm X\%$	FOR TOLERANCES ON FORGING DIMENSIONS SEE BS EN 10243-1		

16 Geometrical tolerancing

Geometrical tolerancing shall conform to the following standards, as appropriate.

BS ISO 1101	<i>Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run-out – Generalities, definitions, symbols, indications on drawings</i>
BS ISO 2692	<i>Technical drawings – Geometrical tolerancing – Maximum material principle</i>
BS EN ISO 5458	<i>Geometrical Product Specifications (GPS) – Geometrical tolerancing – Positional tolerancing</i>
BS ISO 5459	<i>Technical drawings – Geometrical tolerancing – Datums and datum-systems for geometrical tolerances</i>
BS EN ISO 7083	<i>Technical drawings – Symbols for geometrical tolerancing – Proportions and dimensions</i>
BS ISO 10578	<i>Technical drawings – Tolerancing of orientation and location – Projected tolerance zone</i>
DD CEN/ISO TS 12180-1	<i>GPS – Cylindricity – Part 1: Vocabulary and parameters of cylindrical form</i>

DD CEN/ISO TS 12180-2	<i>GPS – Cylindricity – Part 2: Specification operators</i>
DD CEN/ISO TS 12181-1	<i>GPS – Roundness – Part 1: Vocabulary and parameters of roundness</i>
DD CEN/ISO TS 12181-2	<i>GPS – Roundness – Part 2: Specification operators</i>
DD CEN/ISO TS 12780-1	<i>GPS – Straightness – Part 1: Vocabulary and parameters of straightness</i>
DD CEN/ISO TS 12780-2	<i>GPS – Straightness – Part 2: Specification operators</i>
DD CEN/ISO TS 12781-1	<i>GPS – Flatness – Part 1: Vocabulary and parameters of flatness</i>
DD CEN/ISO TS 12781-2	<i>GPS – Flatness – Part 2: Specification operators</i>

17 Surface texture indication

Indication of surface texture shall conform to the following standards.

BS EN ISO 1302	<i>Geometrical Product Specifications (GPS) – Indication of surface texture in technical product documentation</i>
BS EN ISO 8785	<i>Geometrical product specification (GPS) – Surface imperfections – Terms definitions and parameters</i>

The correct application of BS EN ISO 1302 requires the use of the following standards. Other normative references of BS EN ISO 1302 are also referenced in this standard.

BS EN ISO 3274	<i>Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments</i>
BS EN ISO 4287	<i>Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters</i>
BS EN ISO 4288	<i>Geometrical Product Specification (GPS) – Surface texture – Profile method: Rules and procedures for the assessment of surface texture</i>
BS ISO 10135	<i>Technical drawings – Simplified representation of moulded, cast and forged parts</i>
BS EN ISO 11562	<i>Geometrical Product Specifications (GPS) – Surface texture: Profile method – Metrological characteristics of phase correct filters</i>
BS EN ISO 12085	<i>Geometrical Product Specifications (GPS) – Surface texture: Profile method – Motif parameters</i>
BS EN ISO 13565-1	<i>Geometric Product Specifications (GPS) – Surface texture: Profile method – Surfaces having stratified functional properties – Part 1: Filtering and general measurement conditions</i>

