TECHNICAL REPORT

ISO/TR 23605

First edition
2009-12-15

Technical product specification (TPS) — Application guidance — International model for national implementation

Spécification technique de produits (TPS) — Lignes directrices d'application — Modèle international pour mises en oeuvre nationales

Reference number
ISO/TR 23605:2009(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 23605 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

Introduction

Industry in all developed countries worldwide is showing an increasing tendency to focus on design and assembly activity and to contract out the manufacture of its components, and such procedures are unlikely to be constrained by national borders. Alongside this, many companies are extending their dependence on computerized systems and thereby reducing the opportunity for human intervention in manufacturing processes.

One effect of these parallel trends is the exposure of the limitations of some traditional specification processes, which highlights the urgent need for enhanced detail and accuracy in specifying the manufacture of technical products. This is coupled with the requirement to reduce ambiguity and the opportunity for interpretation at both manufacturing and verification stages.

ISO/TR 23605 is drafted with the sole objective of facilitating this improvement in technical product specification through the application of established International Standards and International Standards under development.

A primary objective of the responsible ISO committees is to ensure that the necessary tools to enable the preparation of detailed, accurate specifications are available. Their activity covers seven complementary generic subject areas:

— Methodology for design implementation

— Geometrical product specification

— Graphical representation (engineering drawings/diagrams and 3-D modelling)

— Verification (metrology and precision measurement)

— Technical documentation

— Electronic formats and controls

— Related tools and equipment

There are two ISO Technical Committees responsible for identifying and evaluating requirements for International Standards relating to the preparation, presentation and validation of technical specifications in the field of mechanical engineering and for the drafting of any such standards for which a genuine need is established. Their combined work programmes address the requirements for standardization in such technical specifications at all stages from the preparation of design concepts for physical realization to the validation of finished products.

Technical Product Documentation (TPD) is the province of ISO/TC 10, with the brief “to develop, co-ordinate and maintain International Standards for TPD, including technical drawings manually produced or computer based, for technical purposes throughout the product life cycle in order to facilitate preparation, management, storage, retrieval, reproduction, exchange and use”.

Although this committee is founded on the more traditional discipline of “Engineering Drawing”, its remit extends to include the presentation of all forms of specification for technical products, whatever the media selected to carry that specification. In particular, this includes the graphical representation and annotation of the output of 3-D modelling programmes. The work of ISO/TC 10 is closely linked to that of ISO/TC 213 (see below) and the closest practicable liaisons are maintained, both at the policy-making level and between the working groups.

ISO/TC 213 is the Technical Committee responsible for the development of standards for Geometrical Product Specification (GPS). Its primary objective is the development and promotion of an integrated system for specification and verification of workpiece geometry that can function as an enhanced engineering tool for product development and manufacturing. Such a system is essential as companies move ahead rapidly with new technologies, new manufacturing processes, new materials and technically advanced products, in the previously referred to environment of “international outsourcing”.

This ISO Technical Report sets out the format and overall content of a specification for the preparation of all forms of technical product specification (TPS). It is designed to facilitate the development of national standards for the definition, specification and graphical representation of technical products and includes cross-references to a range of International Standards (the core range) judged to be essential to the achievement of international compatibility between such national standards. This core range of cross-referenced standards incorporates not only those prepared by ISO/TC 213 but also by other relevant ISO Technical committees, principally by ISO/TC 10. It is intended that this model be adopted, in its entirety, by national standards bodies as the basis for their national standards in the field of mechanical engineering specification. Attention is drawn to the fact that its structure provides for the addition of supplementary information by way of commentary and recommendation where national requirements make such addition appropriate, provided that any such additions are not in conflict with the published International Standards.

The relationship between the cross-referenced standards is formally structured within this Technical Report. Additionally, an overview of the international standardization of geometrical product specification, explaining the concept and providing a matrix of the relevant standards, may be found in ISO/TR 14638.

Standards developed in the field of GPS form an interrelated standards structure providing fundamental rules for geometrical specification (see Annex B, Figure B.1).

In ISO/TR 23605 the Geometrical Product Specification (GPS) standards are applied in conjunction with the presentational Technical Product Documentation (TPD) standards to construct a comprehensive system for “Technical Product Specification (TPS)”.

It is appropriate to apply TPS principles throughout the development of a product, i.e. in design, manufacturing, metrology and verification, and it will be found that consistent application will lead to reduced ambiguity and misunderstanding which in turn will provide faster, more controlled “release-to-market” times, with significantly fewer re-starts and reduced requirement for corrective action.

Technical product specification (TPS) — Application guidance — International model for national implementation

1 Scope

This Technical Report provides guidance for the preparation of all technical product specifications in the mechanical engineering field. The document operates as an index to the many ISO standards applicable to a TPS by means of cross-reference, and, where appropriate, the subject references are supplemented by commentary and recommendations considered to be of significance but which are not otherwise covered.

2 Normative references

The following referenced documents, 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.

ISO 10209-1, *Technical product documentation — Vocabulary — Part 1: Terms relating to technical drawings: general and types of drawings*

ISO 10209-2, *Technical product documentation — Vocabulary — Part 2: Terms relating to projection methods*

ISO 14660-1, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10209-1, ISO 10209-2, ISO 14660-1 and the following apply.

NOTE Access to a list GPS terms (in English) providing reference to the ISO document in which the term is defined or used (if not defined) is available via the ISO/TC 213 homepage at http://isotc213.ds.dk.

3.1
technical product documentation
TPD
means of conveying all or part of a design definition or specification of a product

3.2
technical product specification
TPS
technical product documentation comprising the complete design definition and specification of a product for manufacturing and verification purposes

NOTE 1 A TPS, which may contain drawings, 3-D models, parts lists or other documents forming an integral part of the specification, in whatever format they may be presented, may consist of one or more TPDs.

NOTE 2 Attention is drawn to the fact that although the application of ISO/TR 23605 is voluntary, any TPS referred to within contractual obligations will itself become a legal document.

4 Global Standards underpinning ISO/TR 23605

4.1 The GPS Matrix

The GPS Matrix (see Annex B) embodies the concept of "Global" standards that underpin or influence the whole Technical Product Specification process. This principle is adopted in ISO/TR 23605, and the following standards are identified as being "Global" standards for this purpose.

ISO 1, *Geometrical Product Specifications (GPS) — Standard reference temperature for geometrical product specification and verification*

ISO 10579, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*

ISO 14253-1, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*

ISO/TS 14253-2, *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*

ISO/TR 16015, *Geometrical product specifications (GPS) — Systematic errors and contributions to measurement uncertainty of length measurement due to thermal influences*

In addition, the principles addressed in the following documents are considered to underpin the provisions of this Technical Report:

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms* (VIM)

NOTE Amendments to these documents are available from (To be added - sources not yet determined).

4.2 Standard reference temperature

The standard reference temperature for technical product specification and verification is 20 °C (see ISO 1).

5 Expression of the concept

Before specifying a technical product, the broad requirement should be established, with particular attention being paid to the functions that the product will be expected to fulfil. The conceptual design intent can then be depicted in the form of a design layout, scheme or simplified computer-generated model, although this will not normally be used in the detailed technical product document for manufacturing purposes.

The importance of this stage cannot be over-emphasized. Clear understanding of the purpose and function intended for the eventual product, knowledge of the requirements of the available manufacturing methods and awareness of relevant verification procedures will help to ensure that the degree of complexity of the specification is appropriate and adequate.

It is not the aim of this Technical Report to attempt to instruct or constrain the design process. It is, however, of the greatest importance that the designer present the product of the design process, i.e. the TPD set containing the technical product specification, in a manner that avoids ambiguity and any risk of misunderstanding or misinterpretation. For this reason, it is imperative that the designer be familiar with the guidance within this document and aware of the increased precision that its use can bring.

For these and many other reasons, management of the overall design process can be complex, and it is strongly recommended that designers familiarize themselves with published standards in this field.

6 Types of documentation

6.1 General

The technical product document should, if practicable, be of a type listed in one of the following standards and be prepared in accordance with any corresponding recommendations therein:

ISO 7573, *Technical product documentation — Parts lists*

ISO 10209-1, *Technical product documentation — Vocabulary — Part 1: Terms relating to technical drawings: general and types of drawings*

ISO 16792, *Technical product documentation — Digital product definition data practices*

6.2 Commentary and recommendations

6.2.1 Combined drawing

For some TPS, it might be appropriate to display an assembly, item list and constituent details, drawn separately, all on the same drawing (see ISO/TS 8062-2).

6.2.2 Document list (drawing list)

For some TPS, it may be appropriate to provide a list of all graphical representations and selected specifications required to build a particular assembly, from which it derives its title and primary identifier.

7 Relationship between design definition and interpretation

7.1 Targeting of a TPD

When producing a TPD for manufacturing purposes, there can be benefits in giving consideration to how it will be interpreted:

— including more detail than is necessary for the manufacturing operation can increase the risk of misinterpretation;

— including requirements which are beyond the capability of the manufacturing process will lead to an increase in non-compliance.

7.2 Uncertainty of specification

However much care is invested in the preparation of a TPS, there will inevitably be areas of uncertainty, both within the specification and between the specification and the verification processes. To ensure that the uncertainty is minimized, the principles applied should conform to the following standards:

ISO/TS 17450-1, *Geometrical product specifications (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

ISO/TS 17450-2, *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*

8 Presentation media

The presentation of the drawings should conform to the following standards:

ISO 5457, *Technical product documentation — Sizes and layout of drawing sheets*

ISO 7200, *Technical product documentation — Data fields in title blocks and document headers*

9 Scales

Scales should conform to:

ISO 5455, *Technical drawing — Scales*

10 Lines, arrows and terminators

10.1 Lines

Lines should conform to the following standards, as appropriate:

ISO 128-1, *Technical drawings — General principles of presentation — Part 1: Introduction and index*

ISO 128-20, *Technical drawings — General principles of presentation — Part 20: Basic conventions for lines*

ISO 128-21, *Technical drawings — General principles of presentation — Part 21: Preparation of lines by CAD systems*

ISO 128-22, *Technical drawings — General principles of presentation — Part 22: Basic conventions and applications for leader lines and reference lines*

ISO 128-24, *Technical drawings — General principles of presentation — Part 24: Lines on mechanical engineering drawings*

ISO 128-25, *Technical drawings — General principles of presentation — Part 25: Lines on shipbuilding drawings*

10.2 Arrows and terminators

Arrows and terminators composed of lines should conform to:

ISO 129-1, *Technical drawings — Indication of dimensions and tolerances — General principles*

11 Lettering

Lettering should conform to:

ISO 3098-0, *Technical product documentation — Lettering — Part 0: General requirements*

and to the following standards, as appropriate:

ISO 3098-2, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

ISO 3098-3, *Technical product documentation — Lettering — Part 3: Greek alphabet*

ISO 3098-4, *Technical product documentation — Lettering — Part 4: Diacritical and particular marks for the Latin alphabet*

ISO 3098-5, *Technical product documentation — Lettering — Part 5: CAD lettering of the Latin alphabet, numerals and marks*

ISO 3098-6, *Technical product documentation — Lettering — Part 6: Cyrillic alphabet*

12 Projections

Projection methods are introduced in ISO 5456-1, *Technical drawings — Projection methods — Part 1: Synopsis*, and should conform to one of the following standards:

ISO 5456-2, *Technical drawings — Projection methods — Part 2: Orthographic representations*

ISO 5456-3, *Technical drawings — Projection methods — Part 3: Axonometric representations*

ISO 5456-4, *Technical drawings — Projection methods — Part 4: Central projection*

ISO 10209-2, *Technical product documentation — Vocabulary — Part 2: Terms relating to projection methods*

13 Views

Views should conform to:

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

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

14 Sections

Sections should conform to:

ISO 128-40, *Technical drawings — General principles of presentation — Part 40: Basic conventions for cuts and sections*

ISO 128-44, *Technical drawings — General principles of presentation — Part 44: Sections on mechanical engineering drawings*

ISO 128-50, *Technical drawings — General principles of presentation — Part 50: Basic conventions for representing areas on cuts and sections*

15 Part references

Part references should conform to:

ISO 6433, *Technical drawings — Item references*

16 Graphical representation (abbreviations and symbols)

16.1 Abbreviations

Abbreviated terms should be used with care, and their use should be limited to those cases where it is not likely to cause confusion. The general rule is that an abbreviated term comprises capital letters, without a full stop after each letter (see ISO/IEC Directives, Part 2:2004, 6.6.2).

16.2 Symbols used for physical quantities

Symbols used for physical quantities and units of measurement should conform to the following standards, as appropriate:

ISO 80000-1, *Quantities and units — Part 1: General*

ISO 80000-2, *Quantities and units — Part 2: Mathematical signs and symbols to be used in the natural sciences and technology*

ISO 80000-3, *Quantities and units — Part 3: Space and time*

ISO 80000-4, *Quantities and units — Part 4: Mechanics*

ISO 80000-5, *Quantities and units — Part 5: Thermodynamics*

IEC 80000-6, *Quantities and units — Part 6: Electromagnetism*

ISO 80000-7*, Quantities and units — Part 7: Light*

ISO 80000-8, *Quantities and units — Part 8: Acoustics*

ISO 80000-9, *Quantities and units — Part 9: Physical chemistry and molecular physics*

ISO 80000-10, *Quantities and units — Part 10: Atomic and nuclear physics*

ISO 80000-11*, Quantities and units — Part 11: Characteristic numbers*

IEC 80000-13, *Quantities and units — Part 13: Information science and technology*

IEC 80000-14, *Quantities and units — Part 14: Telebiometrics related to human physiology*

These symbols should not be used to represent any other concept, and abbreviations should not be used instead of letter symbols.

16.3 General symbols

Symbols used to convey concepts, other than those for physical quantities and units of measurement, in TPS should conform to the following standards, where appropriate.

These symbols should not be used to represent any other concept.

ISO 701, *International gear notation — Symbols for geometrical data*

ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 3952-1, *Kinematic diagrams — Graphical symbols — Part 1*

ISO 3952-2, *Kinematic diagrams — Graphical symbols — Part 2*

ISO 3952-3, *Kinematic diagrams — Graphical symbols — Part 3*

ISO 3952-4, *Kinematic diagrams — Graphical symbols — Part 4*

ISO 5784-1, *Fluid power systems and components — Fluid logic circuits — Part 1: Symbols for binary logic and related functions*

ISO 5784-2, *Fluid power systems and components — Fluid logic circuits — Part 2: Symbols for supply and exhausts as related to logic symbols*

ISO 5784-3, *Fluid power systems and components — Fluid logic circuits — Part 3: Symbols for logic sequencers and related functions*

ISO 7083, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*

ISO 14617-1, *Graphical symbols for diagrams — Part 1: General information and indexes*

ISO 14617-2, *Graphical symbols for diagrams — Part 2: Symbols having general application*

ISO 14617-3, *Graphical symbols for diagrams — Part 3: Connections and related devices*

ISO 14617-4, *Graphical symbols for diagrams — Part 4: Actuators and related devices*

ISO 14617-5, *Graphical symbols for diagrams — Part 5: Measurement and control devices*

ISO 14617-6, *Graphical symbols for diagrams — Part 6: Measurement and control functions*

ISO 14617-7, *Graphical symbols for diagrams — Part 7: Basic mechanical components*

ISO 14617-8, *Graphical symbols for diagrams — Part 8: Valves and dampers*

ISO 14617-9, *Graphical symbols for diagrams — Part 9: Pumps, compressors and fans*

ISO 14617-10, *Graphical symbols for diagrams — Part 10: Fluid power converters*

ISO 14617-11, *Graphical symbols for diagrams — Part 11: Devices for heat transfer and heat engines*

ISO 14617-12, *Graphical symbols for diagrams — Part 12: Devices for separating, purification and mixing*

ISO 81714-1, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

16.4 Textual equivalents

Textual equivalents are used as a supplement to drawing indication standards for communication purposes and should not be used to specify requirements. Guidance on the use of textual equivalents can be found in:

ISO 9013, *Thermal cutting — Classification of thermal cuts — Geometrical product specification and quality tolerances*

ISO 13920, *Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position*

16.5 Representation of processes

The representation of processes should conform to the following standards:

ISO 2553, *Welded, brazed and soldered joints — Symbolic representation on drawings*

ISO 15785 *Technical drawings — Symbolic presentation and indication of adhesive, fold and pressed joints*

ISO 15787 *Technical product documentation — Heat-treated ferrous parts — Presentation and indications*

17 Representation of features

Conventions used for the representation of features should conform to the following standards, as appropriate:

ISO 1119, *Geometrical Product specifications (GPS) — Series of conical tapers and taper angles*

ISO 2538, *Geometrical Product specifications (GPS) — Series of angles and slopes on prisms*

ISO 5261, *Technical drawings — Simplified representation of bars and profile sections*

ISO 6410-1, *Technical drawings — Screw threads and threaded parts — Part 1: General conventions*

ISO 6410-2, *Technical drawings — Screw threads and threaded parts — Part 2: Screw thread inserts*

ISO 6410-3, *Technical drawings — Screw threads and threaded parts — Part 3: Simplified representation*

ISO 6411, *Technical drawings — Simplified representation of centre holes*

ISO 6413, *Technical drawings — Representation of splines and serrations*

ISO 13715, *Technical drawings — Edges of undefined shape — Vocabulary and indications*

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

ISO 15786, *Technical drawings — Simplified representation and dimensioning of holes*

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

18 Representation of components

Conventions used for the representation of components should conform to the following standards, as appropriate:

ISO 2162-1, *Technical product documentation — Springs — Part 1: Simplified representation*

ISO 2203, *Technical drawings — Conventional representation of gears*

ISO 5845-1, T*echnical drawings — Simplified representation of the assembly of parts with fasteners — Part 1: General principles*

ISO 6410-1, *Technical drawings — Screw threads and threaded parts — Part 1: General conventions*

ISO 6410-2, *Technical drawings — Screw threads and threaded parts — Part 2: Screw thread inserts*

ISO 6410-3, *Technical drawings — Screw threads and threaded parts — Part 3: Simplified representation*

ISO 8826-1, *Technical drawings — Rolling bearings — Part 1: General simplified representation*

ISO 8826-2, *Technical drawings — Rolling bearings — Part 2: Detailed simplified representation*

ISO 9222-1, *Technical drawings — Seals for dynamic application — Part 1: General simplified representation*

ISO 9222-2, *Technical drawings — Seals for dynamic application — Part 2: Detailed simplified representation*

ISO 10135, *Geometrical product specifications (GPS) — Drawing indications for moulded parts in technical product documentation (TPD)*

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

19 Dimensioning and tolerancing

19.1 General

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

ISO 129-1, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

ISO 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances of linear sizes — Part 1: Basis of tolerances, deviations and fits*

ISO 286-2, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 406, *Technical drawings — Tolerancing of linear and angular dimensions*

ISO 1660, *Technical drawings — Dimensioning and tolerancing of profiles*

ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 2768-2, *General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications*

ISO 3040, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Cones*

ISO 6410-1, *Technical drawings — Screw threads and threaded parts — Part 1: General conventions*

ISO 7083, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*

ISO 8015, *Technical drawings — Fundamental tolerancing principle*

ISO 8062-1, *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 1: Vocabulary*

ISO/TS 8062-2, *Geometrical Product Specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 2: Rules*

ISO 8062-3, *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 3: General dimensional and geometrical tolerances and machining allowances for castings*

ISO 10579, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*

19.2 Decimal marker

The decimal marker shall be a comma (see ISO/IEC Directives, Part 2:2004, 6.6.8.1).

Each group of three digits, counting from the decimal marker to the left and to the right, should be separated from other digits by a small space (e.g. 12 345,067 8). The use of a comma or a point for this purpose is deprecated. (See ISO 31-0:1992, *Quantities and units — Part 0: General principle*s.).

20 Geometrical tolerancing

Geometrical tolerancing should conform to the following standards, as appropriate:

ISO 1101, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 2692, *Geometrical product specifications (GPS) — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)*

ISO 5458, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Positional tolerancing*

ISO 5459, *Technical drawings — Geometrical tolerancing — Datums and datum-systems for geometrical tolerances*

ISO 10578, *Technical drawings — Tolerancing of orientation and location — Projected tolerance zone*

ISO 14660-1, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

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*

21 Surface texture indication

Indication of surface texture should conform to:

ISO 1302, *Geometrical Product Specifications — Indication of surface texture in technical product documentation*

It is necessary that users of ISO/TR 23605 be aware that the correct application of ISO 1302 requires the use of the following International Standards:

ISO 3098-2, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

ISO 3274, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*

ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 8785, *Geometrical Product Specification (GPS) — Surface imperfections — Terms, definitions and parameters*

ISO 11562, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Metrological characteristics of phase correct filters*

ISO 12085, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Motif parameters*

ISO 13565-1, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 1: Filtering and general measurement conditions*

ISO 13565-2, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 2: Height characterization using the linear material ratio curve*

ISO 13565-3, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Surfaces having stratified functional properties — Part 3: Height characterization using the material probability curve*

ISO 14253-1, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*

ISO 14660-1, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

ISO 16610 (all parts), *Geometrical product specifications (GPS) — Filtration*

ISO 25178 (all parts), *Geometrical product specifications (GPS) — Surface texture: Areal*

NOTE Whilst the principle of cross-referencing is one regularly applied in standards, ISO 1302 itself is of such significance and the number of standards involved of such a magnitude, that it is considered appropriate to ensure their inclusion in ISO/TR 23605 in this way.

22 Security

22.1 Introduction

Many TPSs have minimal requirements for security, other than those provided by general handling and storage procedures (see Clause 23). However, where a specific need for a general level of security is identified, the following requirements should be met.

22.2 General security

Procedures for ensuring the security of TPDs and TPSs, should conform to:

ISO 11442, *Technical product documentation — Document management*

ISO 15489-1, *Information and documentation — Records management — Part 1: General*

23 Storage and retrieval

Methods for storage and retrieval of the document should conform to the following standards, as appropriate:

ISO 6428, *Technical drawings — Requirements for microcopying*

ISO 15489-1*, Information and documentation — Records management — Part 1: General*

24 Protection notices

It is suggested that where it is considered appropriate to place restrictions on the use of technical product documentation, the recommendations contained in the following standard be applied:

ISO 16016:2000, *Technical product documentation — Protection notices for restricting the use of documents and products*

Annex A
(normative)

Cross-referenced standards

A.1 General

Table A.1 lists standards containing requirements that need to be met in order to claim compliance with ISO/TR 23605. It also identifies in which clause or subclause of this part of ISO/TR 23605 each of these standards is referenced.

A.2 Abbreviations used in Table A.1

GPP general principles of presentation

GPS geometrical product specifications

GT geometrical tolerancing

HCTI handling of computer-based technical information

STTP screw threads and threaded parts

TD technical drawings

Table A.1 — Cross-referenced standards

Standard referred to	Title of the standard	ISO/TR 23605 clause
ISO 1	*GP — Standard reference temperature for geometrical product specification and verification*	**4.1; 4.2**
ISO 128-1	*TD — GPP — Part 1: Introduction and index*	**10.1**
ISO 128-20	*TD — GPP — Part 20: Basic conventions for lines*	**10.1**
ISO 128-21	*TD — GPP — Part 21: Preparation by CAD systems*	**10.1**
ISO 128-22	*TD — GPP — Part 22: Leader lines and reference lines*	**10.1**
ISO 128-24	*TD — GPP — Part 24: Lines on mechanical engineering drawings*	**10.1**
ISO 128-25	*TD — GPP — Part 25: Lines on shipbuilding drawings*	**10.1**
ISO 128-30	*TD — GPP — Part 30: Basic conventions for views*	**13**
ISO 128-34	*TD — GPP — Part 34: Views on mechanical engineering drawings*	**13**
ISO 128-40	*TD — GPP — Part 40: Basic conventions for cuts and sections*	**14**
ISO 128-44	*TD — GPP — Part 44: Sections on mechanical engineering drawings*	**14**
ISO 128-50	*TD — GPP — Part 50: Basic conventions for representing areas on cuts and sections*	**14**
ISO 129-1	*TD — Indication of dimensions and tolerances — Part 1: General principles*	**10.2; 19.1**
ISO 286-1	*GPS — ISO code system for tolerances of linear sizes — Part 1: Bases of tolerances, deviations and fits*	**19.1**
ISO 286-2	*ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*	**19.1**
ISO 406	*TD — Tolerancing of linear and angular dimensions*	**19.1**
ISO 701	*International gear notation — Symbols for geometrical data*	**16.3**
ISO 1101	*GPS — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*	**20**
ISO 1119	*GPS — Series of conical tapers and taper angles*	**17**
ISO 1219-1	*Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*	**16.3**
ISO 1302	*GPS — Indication of surface texture in technical product documentation*	**21**
ISO 1660	*TD — Dimensioning and tolerancing of profiles*	**19.1**
ISO 2162-1	*TPD — Springs — Part 1: Simplified representation*	**18**
ISO 2203	*TD — Conventional representation of gears*	**18**
ISO 2538	*GPS — Series of angles and slopes on prisms*	**17**
ISO 2553	*Welded, brazed and soldered joints — Symbolic representation on drawings*	**16.5**
ISO 2692	*GPS — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)*	**20**
ISO 2768-1	*General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*	**19.1**
ISO 2768-2	*General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications*	**19.1**
ISO 3040	*GPS — Dimensioning and tolerancing — Cones*	**19.1**

Table A.1 (*continued*)

Standard referred to	Title of the standard	ISO/TR 23605 clause
ISO 3098-0	*TPD — Lettering — Part 0: General requirements*	**11**
ISO 3098-2	*TPD — Lettering — Part 2: Latin alphabet, numerals and marks*	**11: 21**
ISO 3098-3	*TPD — Lettering — Part 3: Greek alphabet*	**11**
ISO 3098-4	*TPD — Lettering — Part 4: Diacritical and particular marks for the Latin alphabet*	**11**
ISO 3098-5	*TPD — Lettering — Part 5: CAD lettering of the Latin alphabet, numerals and marks*	**11**
ISO 3098-6	*TPD — Lettering — Part 6: Cyrillic alphabet*	**11**
ISO 3274	*GPS — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*	**21**
ISO 3952-1	*Kinematic diagrams — Graphical symbols — Part 1:*	**16.3**
ISO 3952-2	*Kinematic diagrams — Graphical symbols — Part 2:*	**16.3**
ISO 3952-3	*Kinematic diagrams — Graphical symbols — Part 3:*	**16.3**
ISO 3952-4	*Kinematic diagrams — Graphical symbols — Part 4:*	**16.3**
ISO 4287	*GPS — Surface texture: Profile method —Terms, definitions and surface texture parameters*	**21**
ISO 4288	*GPS — Surface texture: Profile method —Rules and procedures for the assessment of surface texture*	**21**
ISO 5261	*TD — Simplified representation of bars and profile sections*	**17**
ISO 5455	*TD — Scales*	**9**
ISO 5456-1	*TD — Projection methods — Part 1: Synopsis*	**12**
ISO 5456-2	*TD — Projection methods — Part 2: Orthographic representations*	**12**
ISO 5456-3	*TD — Projection methods — Part 3: Axonometric representations*	**12**
ISO 5456-4	*TD — Projection methods — Part 4: Central projection*	**12**
ISO 5457	*TPD — Sizes and layout of drawing sheets*	**8.1**
ISO 5458	*GPS — GT — Positional tolerancing*	**20**
ISO 5459	*TD — GT — Datums and datum-systems for geometrical tolerances*	**20**
ISO 5784-1	*Fluid power systems and components — Fluid logic circuits — Part 1: Symbols for binary logic and related functions*	**16.3**
ISO 5784-2	*Fluid power systems and components — Fluid logic circuits — Part 2: Symbols for supply and exhausts as related to logic symbols*	**16.3**
ISO 5784-3	*Fluid power systems and components — Fluid logic circuits — Part 3: Symbols for logic sequencers and related functions*	**16.3**
ISO 5845-1	*TD — Simplified representation of the assembly of parts with fasteners — Part 1: General principles*	**18**
ISO 6410-1	*TD — STTP — Part 1: General conventions*	**17. 18.19.1**
ISO 6410-2	*TD — STTP — Part 2: Screw thread inserts*	**17. 18**
ISO 6410-3	*TD — STTP — Part 3: Simplified representation*	**17. 18**
ISO 6411	*TD — Simplified representation of centre holes*	**17.**
ISO 6413	*TD — Representation of splines and serrations*	**17.**
ISO 6428	*TD — Requirements for microcopying*	**23**

Table A.1 (*continued*)

Standard referred to	Title of the standard	ISO/TR 23605 clause
ISO 6433	*TD — Item references*	**15**
ISO 7083	*TD — Symbols for geometrical tolerancing — Proportions and dimensions*	**16.3; 19 1**
ISO 7200	*TPD — Data fields in title blocks and document headers*	**8.1**
ISO 7573	*TPD — Parts lists*	**6.1**
ISO 8015	*TD — Fundamental tolerancing principle*	**19.1**
ISO 8062-1	*GPS — Dimensional and geometrical tolerances for moulded parts — Part 1: Vocabulary*	**19.1**
ISO/TS 8062-2	*Geometrical Product Specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 2: Rules*	**6.1, 19.1**
ISO 8062-3	*GPS — Dimensional and geometrical tolerances for moulded parts — Part 3: General dimensional and geometrical tolerances and machining allowances for castings*	**19.1**
ISO 8785	*GPS — Surface imperfections — Terms, definitions and parameters*	**21**
ISO 8826-1	*TD — Rolling bearings — Part 1: General simplified representation*	**18**
ISO 8826-2	*TD — Rolling bearings — Part 2: Detailed simplified representation*	**18**
ISO 9013	*Thermal cutting — Classification of thermal cuts — Geometrical product specification and quality tolerances*	**16.4**
ISO 9222-1	*TD — Seals for dynamic application — Part 1: General simplified representation*	**18**
ISO 9222-2	*TD — Seals for dynamic application — Part 2: Detailed simplified representation*	**18**
ISO 10135	*GPS — Drawing indications for moulded parts in technical product documentation (TPD)*	**18**
ISO 10209-1	*TPD — Vocabulary — Part 1: Terms relating to technical drawings: general and types of drawing*	**3; 6.1**
ISO 10209-2	*TPD — Vocabulary — Part 2: Terms relating to projection methods*	**3; 12**
ISO 10578	*TD — Tolerancing of orientation and location — Projected tolerance zone*	**20**
ISO 10579	*GPS — Dimensioning and tolerancing — Non-rigid parts*	**4.1; 19.1**
ISO 11442	*TPD —Document management*	**22.2**
ISO 11562	*GPS — Surface texture: Profile method — Metrological characteristics of phase correct filters*	**21**
ISO 12085	*GPS — Surface texture: Profile method — Motif parameters*	**21**
ISO 13565-1	*GPS — Surface texture: Profile method; Surfaces having stratified functional properties — Part 1: Filtering and general measurement conditions*	**21**
ISO 13565-2	*GPS — Surface texture: Profile method; Surfaces having stratified functional properties — Part 2: Height characterization using the linear material ratio curve*	**21**
ISO 13565-3	*GPS — Surface texture: Profile method; Surfaces having stratified functional properties — Part 3: Height characterization using the material probability curve*	**21**
ISO 13715	*Technical drawings — Edges of undefined shape — Vocabulary and indications*	**17**
ISO 13920	*Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position*	**16.4**
ISO 14253-1	*GPS — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*	**4.1; 21**

Table A.1 (*continued*)

Standard referred to	Title of the standard	ISO/TR 23605 clause
ISO/TS 14253-2	*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*	**4.1**
ISO 14617-1	*Graphical symbols for diagrams — Part 1: General information and indexes*	**16.3**
ISO 14617-2	*Graphical symbols for diagrams — Part 2: Symbols having general application*	**16.3**
ISO 14617-3	*Graphical symbols for diagrams — Part 3: Connections and related devices*	**16.3**
ISO 14617-4	*Graphical symbols for diagrams — Part 4: Actuators and related devices*	**16.3**
ISO 14617-5	*Graphical symbols for diagrams — Part 5: Measurement and control devices*	**16.3**
ISO 14617-6	*Graphical symbols for diagrams — Part 6: Measurement and control functions*	**16.3**
ISO 14617-7	*Graphical symbols for diagrams — Part 7: Basic mechanical components*	**16.3**
ISO 14617-8	*Graphical symbols for diagrams — Part 8: Valves and dampers*	**16.3**
ISO 14617-9	*Graphical symbols for diagrams — Part 9: Pumps, compressors and fans*	**16.3**
ISO 14617-10	*Graphical symbols for diagrams — Part 10: Fluid power converters*	**16.3**
ISO 14617-11	*Graphical symbols for diagrams — Part 11: Devices for heat transfer and heat engines*	**16.3**
ISO 14617-12	*Graphical symbols for diagrams — Part 12: Devices for separating, purification and mixing*	**16.3**
ISO 14660-1	*GPS — Geometrical features — Part 1: General terms and definitions*	**3; 20; 21**
ISO 14660-2	*GPS — Geometrical features — Part 2: Extracted median line of a cylinder and a cone, extracted median surface, local size of an extracted feature*	**17; 20**
ISO 15489-1	*Information and documentation — Records management — Part 1: General*	**22.2; 23**
ISO 15785	*TD — Symbolic presentation and indication of adhesive, fold and pressed joints*	
ISO 15786	*TD — Simplified representation and dimensioning of holes*	**16.4**
ISO 15787	*TPD — Heat-treated ferrous parts — Presentation and indications*	
ISO/TR 16015	*Geometrical product specifications (GPS) — Systematic errors and contributions to measurement uncertainty of length measurement due to thermal influences*	**4.1**
ISO 16016	*TPD — Protection notices for restricting the use of documents and products*	**24**
ISO 16610 (all parts)	*GPS — Filtration*	**21**
ISO 16792	*TPD — Digital product definition data practices*	**6.1**
ISO/TS 17450–1	*GPS — General concepts — Part 1: Model for geometrical specification and verification*	**7.2**
ISO/TS 17450–2	*GPS — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*	**7.2**
ISO 25178 series	*GPS — Surface texture: Areal*	**21**
ISO 80000-1	*Quantities and units — Part 0: General principles*	**16.2**
ISO 80000-3	*Quantities and units — Part 3: Space and time*	**16.2**
ISO 80000-4	*Quantities and units — Part 4: Mechanics*	**16.2**
ISO 80000-5	*Quantities and units — Part 5: Thermodynamics*	**16.2**
IEC 80000-6	*Quantities and units — Part 6: Electromagnetism*	**16.2**
ISO 80000-7	*Quantities and units — Part 7: Light*	**16.2**

Table A.1 (*continued*)

Standard referred to	Title of the standard	ISO/TR 23605 clause
ISO 80000-8	*Quantities and units — Part 8: Acoustics*	**16.2**
ISO 80000-11	*Quantities and units — Part 11: Characteristic numbers*	**16.2**
IEC 80000-13	*Quantities and units — Part 13: Information science and technology*	**16.2**
IEC 80000-14	*Quantities and units — Part 14: Telebiometrics related to human physiology*	**16.2**
ISO 81714-1	*Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*	**16.3**

Annex B
(informative)

Geometrical product specification (GPS) — The standards matrix

B.1 Introduction

Geometrical product specification (GPS) is a procedure for defining the shape (geometry), dimensions and surface characteristics of a workpiece in a manner that ensures optimum functioning of that workpiece. The procedure includes definition of the dispersion around the optimum within which the intended function will still be satisfactory. The manufacturing process will, nevertheless, produce workpieces that are not perfect, in that they show some deviation from the defined optimum and from each other. When comparing a workpiece with its specification, it is necessary to relate the following:

— the workpiece conceived by the designer;

— the workpiece as manufactured;

— the workpiece as measured.

Standards developed in the field of GPS provide fundamental rules for geometrical specification, such as basic definition, graphical representation and principles of measurement. Several categories of standard relate to the concept, some dealing with the fundamental rules of specification, whilst others provide global principles and definitions. A third group directly addresses various geometric characteristics such as size, distance, angle, form, location, orientation and roughness. The concept includes workpiece characteristics relating to different types of manufacturing process, together with the characteristics of specific machine elements.

B.2 Application of GPS Standards

The relationship between the categories of GPS Standards, as displayed in the GPS Matrix included here as Figure B.1, should be applied throughout ISO/TR 23605.

The fundamental GPS standards

The global GPS standards

GPS standards or related standards which deal with or influence several or all general GPS chains of standards

General GPS matrix

General GPS chains of standards

1. The **Size** chain of standards
2. The **Distance** chain of standards
3. The **Radius** chain of standards
4. The **Angle** chain of standards
5. The **Form of a line (independent of a datum)** chain of standards
6. The **Form of a line (dependent of a datum)** chain of standards
7. The **Form of a Surface (independent of a datum)** chain of standards
8. The **Form of a Surface (dependent of a datum)** chain of standards
9. The **Orientation** chain of standards
10. The **Location** chain of standards
11. The **Circular run-out** chain of standards
12. The **Total run-out** chain of standards
13. The **Datums** chain of standards
14. The **Roughness profile** chain of standards
15. The **Waviness profile** chain of standards
16. The **Primary profile** chain of standards
17. The **Surface imperfections** chain of standards
18. The **Edges** chain of standards

Complementary GPS matrix

Complementary GPS chains of standards

A. Process-specific tolerance standards

A1. The **Machining** chain of standards
A2. The **Moulding** chain of standards
A3. The **Welding** chain of standards
A4. The **Thermal cutting** chain of standards
A5. The **Plastic moulding** chain of standards
A6. The **Metallic and inorganic coating** chain of standards
A7. The **Painting** chain of standards

B. Machine element geometry standards

B1. The **Screw thread** chain of standards
B2. The **Gears** chain of standards
B3. The **Splines** chain of standards

Figure B.1 — The GPS matrix of standards

Bibliography

[1] ISO 31-0:1992, Quantities and units — *Part 0: General principles*

[2] ISO 5456-1, *Technical drawings — Projection methods — Part 1: Synopsis*

[3] ISO/TR 14638, *Geometrical product specification (GPS) — Masterplan*

ICS 01.100.01

Price based on 20 pages