TECHNICAL REPORT

ISO/TR 23605

Second edition
2018-04

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

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO/TR 23605:2009), which has been technically revised.

The main changes to the previous edition are as follows:

— a general update in line with the revised ISO GPS matrix, ISO 14638:2015;

— the category of 'global' standards has been removed, as per ISO 14638:2015, with standards now categorized as 'fundamental' or 'general' ISO GPS standards;

— new, amended and/or revised standards have been added or updated throughout the document, including in Annex A, which lists all cross-referenced standards;

— a new Annex B, 'Withdrawn standards', provides a list of all previously current ISO/TC 213 standards referred to in this document.

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.

This document is drafted with the sole objective of facilitating this improvement in technical product specification (TPS) 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 scope 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, 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 specifications (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 environment previously known as international outsourcing.

This document sets out the format and overall content of a specification for the preparation of all forms of 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 (see Annex A and see Annex B for a list of withdrawn ISO/TC 213 standards). This core range of cross-referenced standards incorporates those prepared not only by ISO/TC 213 but also by other relevant ISO Technical committees, principally 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 document. Additionally, an overview of the international standardization of geometrical product specification, explaining the concept and providing a matrix of the relevant standards, can be found in ISO 14638.

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

In this document, the GPS standards are applied in conjunction with the presentational TPD standards to construct a comprehensive system for 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 restarts and reduced requirement for corrective action.

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

1 Scope

This document provides a list of all ISO geometrical product specification (GPS) and technical product documentation (TPD) standards for technical product specifications (TPS) 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10209:2012, *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10209:2012 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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 to entry: A TPS, which can contain drawings, 3-D models, parts lists or other documents forming an integral part of the specification, in whatever format they are presented, can consist of one or more TPDs.

4   Fundamental and general standards underpinning ISO/TR 23605

4.1   The GPS matrix

The GPS matrix (see Annex C) embodies the concept of 'fundamental' and 'general' standards that underpin or influence the whole TPS process. This principle is adopted in this document, and the following standards are identified as being fundamental or general standards for this purpose.

NOTE   The category of 'global' ISO GPS standards has been removed from ISO 14638, the ISO GPS matrix standard. ISO GPS standards which had previously been categorized as global ISO GPS standards are now categorized as either fundamental or general ISO GPS standards.

ISO 1, *Geometrical product specifications (GPS) — Standard reference temperature for the specification of geometrical and dimensional properties*

ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

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 verifying conformity or nonconformity with specifications*

ISO 14253-2, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2: Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

ISO 14253-3, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 3: Guidelines for achieving agreements on measurement uncertainty statements*

ISO/TS 14253-4, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 4: Background on functional limits and specification limits in decision rules*

ISO 14978, *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*

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

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

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

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

ISO 17450-3, *Geometrical product specifications (GPS) — General concepts — Part 3: Toleranced features*

ISO 17450-4, *Geometrical product specifications (GPS) — Basic concepts — Part 4: Geometrical characteristics for quantifying GPS deviations*

ISO 18391, *Geometrical product specifications (GPS) — Population specification*

ISO 22432, *Geometrical product specifications (GPS) — Features utilized in specification and verification*

ISO 25378, *Geometrical product specifications (GPS) — Characteristics and conditions — Definitions*

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

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)*

4.2   Standard reference temperature

The standard reference temperature for TPS 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 document 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 TPS, 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, *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

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 8015, *Geometrical product specifications — Fundamentals — Concepts, principles and rules*

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

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

ISO/TS 23165, *Geometrical product specifications (GPS) — Guidelines for the evaluation of coordinate measuring machine (CMM) test uncertainty*

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

7.3 Extraction

ISO 14406, *Geometrical product specifications (GPS) — Extraction*

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*

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

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 product documentation (TPD) — Presentation of dimensions and tolerances — Part 1: General principles*

11 Lettering

Lettering should conform to:

ISO 3098-1, *Technical product documentation — Lettering — Part 1: 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, *Technical Product Documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

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 product documentation — Part 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 2:2016, 8.4).

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*

ISO 80000-12, *Quantities and units — Part 12: Solid state physics*

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

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 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 14617-13, *Graphical symbols for diagrams — Part 13: Devices for material processing*

ISO 14617-14, *Graphical symbols for diagrams — Part 14: Devices for transport and handling of material*

ISO 14617-15, *Graphical symbols for diagrams — Part 15: Installation diagrams and network maps*

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, *Welding and allied processes — Symbolic representation on drawings — Welded joints*

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 2538-1, *Geometrical product specifications (GPS) — Wedges — Part 1: Series of angles and slopes*

ISO 2538-2, *Geometrical product specifications (GPS) — Wedges — Part 2: Dimensioning and tolerancing*

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 product documentation — Edges of undefined shape — Indication and dimensioning*

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

ISO 17450-3, *Geometrical product specifications (GPS) — General concepts — Part 3: Toleranced features*

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, *Technical 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 documents, as appropriate:

ISO 129-1, *Technical product documentation (TPD) — Presentation of dimensions and tolerances — Part 1: General principles*

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

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

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

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, *Geometrical product specifications — Fundamentals — Concepts, principles and rules*

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*

ISO 14405-1, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 1: Linear sizes*

ISO 14405-2, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 2: Dimensions other than linear sizes*

ISO 14405-3, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 3: Angular sizes*

ISO 18388, *Technical product documentation (TPD) — Relief grooves — Types and dimensioning*

19.2 Decimal marker

The decimal marker is a comma (see ISO/IEC Directives, Part 2:2016, 9.1).

Each group of three digits is separated by a small space from the preceding digits. This also applies to digits following the decimal sign (e.g. 12 345,067 8). (See ISO 80000-1, *Quantities and units — Part 1: General principles*.)

20 Geometrical tolerancing

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

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

ISO 1660, *Geometrical product specifications (GPS) — Geometrical tolerancing — Profile tolerancing*

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, *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*

ISO 12180-1, *Geometrical product specifications (GPS) — Cylindricity — Part 1: Vocabulary and parameters of cylindrical form*

ISO 12180-2, *Geometrical product specifications (GPS) — Cylindricity — Part 2: Specification operators*

ISO 12181-1, *Geometrical product specifications (GPS) — Roundness — Part 1: Vocabulary and parameters of roundness*

ISO 12181-2, *Geometrical product specifications (GPS) — Roundness — Part 2: Specification operators*

ISO 12780-1, *Geometrical product specifications (GPS) — Straightness — Part 1: Vocabulary and parameters of straightness*

ISO 12780-2, *Geometrical product specifications (GPS) — Straightness — Part 2: Specification operators*

ISO 12781-1, *Geometrical product specifications (GPS) — Flatness — Part 1: Vocabulary and parameters of flatness*

ISO 12781-2, *Geometrical product specifications (GPS) — Flatness — Part 2: Specification operators*

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

ISO 17450-3, *Geometrical product specifications (GPS) — General concepts — Part 3: Toleranced features*

ISO/TS 17863, *Geometrical product specification (GPS) — Tolerancing of moveable assemblies*

21 Surface texture indication

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

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 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 (all parts), *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment*

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

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

NOTE   While 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 magnitude, that it is considered appropriate to ensure their inclusion in this document in this way.

22 Verification

22.1 Instrumentation

ISO 463, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Design and metrological characteristics of mechanical dial gauges*

ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 3650, *Geometrical product specifications (GPS) — Length standards — Gauge blocks*

ISO 7863, *Height setting micrometers and riser blocks*

ISO 8512-1, *Surface plates — Part 1: Cast iron*

ISO 8512-2, *Surface plates — Part 2: Granite*

ISO 9493, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Dial test indicators (lever type) — Design and metrological characteristics*

ISO 12179, *Geometrical product specifications (GPS) — Surface texture: Profile method — Calibration of contact (stylus) instruments*

ISO 13102, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Electronic digital-indicator gauge — Design and metrological characteristics*

ISO 13225, *Geometrical product specifications (GPS) — Dimensional measuring equipment; Height gauges — Design and metrological characteristics*

ISO 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Callipers; Design and metrological characteristics*

ISO 13385-2, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 2: Calliper depth gauges; Design and metrological characteristics*

ISO 14978, *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*

22.2 Acceptance tests

ISO 4291, *Methods for the assessment of departure from roundness — Measurement of variations in radius*

ISO 5436-1, *Geometrical product specifications (GPS) — Surface texture: Profile method; Measurement standards — Part 1: Material measures*

ISO 5436-2, *Geometrical product specifications (GPS) — Surface texture: Profile method; Measurement standards — Part 2: Software measurement standards*

ISO 10360-1, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 1: Vocabulary*

ISO 10360-2, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 2: CMMs used for measuring linear dimensions*

ISO 10360-3, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 3: CMMs with the axis of a rotary table as the fourth axis*

ISO 10360-4, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 4: CMMs used in scanning measuring mode*

ISO 10360-5, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 5: CMMs using single and multiple stylus contacting probing systems*

ISO 10360-6, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 6: Estimation of errors in computing Gaussian associated features*

ISO 10360-7, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 7: CMMs equipped with imaging probing systems*

ISO 10360-8, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 8: CMMs with optical distance sensors*

ISO 10360-9, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 9: CMMs with multiple probing systems*

ISO 10360-10, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 10: Laser trackers for measuring point-to-point distances*

ISO 10360-12, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 12: Articulated arm coordinate measurement machines (CMM)*

ISO 14253-3, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 3: Guidelines for achieving agreements on measurement uncertainty statements*

ISO/TS 14253-4, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 4: Background on functional limits and specification limits in decision rules*

ISO 14253-5, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 5: Uncertainty in verification testing of indicating measuring instruments*

ISO/TR 14253-6, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 6: Generalized decision rules for the acceptance and rejection of instruments and workpieces*

ISO/TS 15530-1, *Geometrical product specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement — Part 1: Overview and metrological characteristics*

ISO 15530-3, *Geometrical product specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement — Part 3: Use of calibrated workpieces or measurement standards*

ISO/TS 15530-4, *Geometrical product specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement — Part 4: Evaluating task-specific measurement uncertainty using simulation*

ISO/TS 17865, *Geometrical product specifications (GPS) — Guidelines for the evaluation of coordinate measuring machine (CMM) test uncertainty for CMMs using single and multiple stylus contacting probing systems*

ISO/TS 23165, *Geometrical product specifications (GPS) — Guidelines for the evaluation of coordinate measuring machine (CMM) test uncertainty*

23 Security

23.1 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.

23.2 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: Concepts and principles*

24 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: Concepts and principles*

25 Protection notices

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

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

Annex A
(informative)

Cross-referenced standards

A.1 General

Table A.1 lists standards containing requirements that need to be met in order to claim compliance with this document. It also identifies in which clause or subclause of this document 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

TPD   technical product documentation

Table A.1 — Cross-referenced standards

Standard	Title	Clause/ subclause in this document
ISO 1	*GPS — Standard reference temperature for the specification of geometrical and dimensional properties*	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 of lines by CAD systems*	10.1
ISO 128-22	*TD — GPP — Part 22: Basic conventions and applications for 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	*TPD — Presentation of dimensions and tolerances — Part 1: General principles*	10.2; 19.1
ISO 286-1	*GPS — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*	19.1

Table A.1 *(continued)*

Standard	Title	Clause/ subclause in this document
ISO 286-2	*GPS — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*	19.1
ISO 701	*International gear notation — Symbols for geometrical data*	16.3
ISO 1101	*GPS — GT — Tolerances of form, orientation, location and run-out*	20
ISO 1119	*GPS — Series of conical tapers and taper angles*	17, 19.1
ISO 1302	*GPS — Indication of surface texture in technical product documentation*	21
ISO 1660	*GPS — GT — Profile tolerancing*	20
ISO 2162-1	*TPD — Springs — Part 1: Simplified representation*	18
ISO 2203	*TD — Conventional representation of gears*	18
ISO 2538-1	*GPS — Wedges — Part 1: Series of angles and slopes*	17
ISO 2538-2	*GPS — Wedges — Part 2: Dimensioning and tolerancing*	17
ISO 2553	*Welding and allied processes — Symbolic representation on drawings — Welded joints*	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
ISO 3098-1	*TPD — Lettering — Part 1: 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

Table A.1 *(continued)*

Standard	Title	Clause/ subclause in this document
ISO 5458	*GPS — GT — Positional tolerancing*	20
ISO 5459	*GPS — GT — Datums and datum systems*	20
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*	24
ISO 6433	*TPD — Part 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
ISO 7573	*TPD — Parts lists*	6.1
ISO 8015	*GPS — Fundamentals — Concepts, principles and rules*	4.1, 7.2, 19.1
ISO 8062-1	*GPS — Dimensional and geometrical tolerances for moulded parts — Part 1: Vocabulary*	19.1
ISO/TS 8062-2	*GPS — Dimensional and geometrical tolerances for moulded parts — Part 2: Rules*	6.2.1, 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	*TPD — Vocabulary — Terms relating to technical drawings, product definition and related documentation*	3, 6.1, 12
ISO 10579	*GPS — Dimensioning and tolerancing — Non-rigid parts*	4.1, 19.1
ISO 11442	*TPD —Document management*	23.2
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

Table A.1 *(continued)*

Standard	Title	Clause/ subclause in this document
ISO 13715	*TPD — Edges of undefined shape — Indication and dimensioning*	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 conformity or nonconformity with specifications*	4.1; 21
ISO 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, 21
ISO 14253-3	*GPS — Inspection by measurement of workpieces and measuring equipment — Part 3: Guidelines for achieving agreements on measurement uncertainty statements*	4.1, 21, 22.2
ISO/TS 14253-4	*Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 4: Background on functional limits and specification limits in decision rules*	4.1, 21, 22.2
ISO 14253-5	*GPS — Inspection by measurement of workpieces and measuring equipment — Part 5: Uncertainty in verification testing of indicating measuring instruments*	21, 22.2
ISO/TR 14253-6	*GPS — Inspection by measurement of workpieces and measuring equipment — Part 6: Generalized decision rules for the acceptance and rejection of instruments and workpieces*	21, 22.2
ISO 14405-1	*GPS — Dimensional tolerancing — Part 1: Linear sizes*	19.1
ISO 14405-2	*GPS — Dimensional tolerancing — Part 2: Dimensions other than linear sizes*	19.1
ISO 14405-3	*GPS — Dimensional tolerancing — Part 3: Angular sizes*	19.1
ISO 14406	*GPS — Extraction*	7.3
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 14617-13	*Graphical symbols for diagrams — Part 13: Devices for material processing*	16.3
ISO 14617-14	*Graphical symbols for diagrams — Part 14: Devices for transport and handling of material*	16.3
ISO 14617-15	*Graphical symbols for diagrams — Part 15: Installation diagrams and network maps*	16.3
ISO 14978	*GPS — General concepts and requirements for GPS measuring equipment*	4.1, 22.1
ISO 15489-1	*Information and documentation — Records management — Part 1: General*	23.2; 24
ISO 15785	*TD — Symbolic presentation and indication of adhesive, fold and pressed joints*	16.5

Table A.1 *(continued)*

Standard	Title	Clause/ subclause in this document
ISO 15786	*TD — Simplified representation and dimensioning of holes*	17
ISO 15787	*TPD — Heat-treated ferrous parts — Presentation and indications*	16.5
ISO/TR 16015	*GPS — Systematic errors and contributions to measurement uncertainty of length measurement due to thermal influences*	4.1, 7.2
ISO 16016	*TPD — Protection notices for restricting the use of documents and products*	8, 25
ISO 16610 (all parts)	*GPS — Filtration*	4.1, 20, 21
ISO 16792	*TPD — Digital product definition data practices*	6.1
ISO 17450-1	*GPS — General concepts — Part 1: Model for geometrical specification and verification*	4.1, 7.2
ISO 17450-2	*GPS — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*	4.1, 7.2
ISO 17450-3	*GPS — General concepts — Part 3: Toleranced features*	4.1, 17
ISO 17450-4	*GPS — Basic concepts — Part 4: Geometrical characteristics for quantifying GPS deviations*	4.1
ISO/TS 17865	*GPS — Guidelines for the evaluation of coordinate measuring machine (CMM) test uncertainty for CMMs using single and multiple stylus contacting probing systems*	22.2
ISO 18388	*TPD — Relief grooves — Types and dimensioning*	19.1
ISO 22432	*GPS — Features utilized in specification and verification*	4.1
ISO 25178 series	*GPS — Surface texture: Areal*	21
ISO 25378	*GPS — Characteristics and conditions — Definitions*	4.1
ISO 80000-1	*Quantities and units — Part 1: General principles*	16.2
ISO 80000-2	*Quantities and units — Part 2: Mathematical signs and symbols to be used in the natural sciences and technology*	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
ISO 80000-8	*Quantities and units — Part 8: Acoustics*	16.2
ISO 80000-9	*Quantities and units — Part 9: Physical chemistry and molecular physics*	16.2
ISO 80000-10	*Quantities and units — Part 10: Atomic and nuclear physics*	16.2
ISO 80000-11	*Quantities and units — Part 11: Characteristic numbers*	16.2
ISO 80000-12	*Quantities and units — Part 12: Solid state physics*	16.2
IEC 80000-13	*Quantities and units — Part 13: Information science and technology*	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)

Withdrawn standards

This annex lists the withdrawn versions of all ISO/TC 213 standards as per the ISO/TC 213 page on the ISO website:

https://www.iso.org/committee/54924.html

ISO 1:1975, *Standard reference temperature for industrial length measurements*

ISO 1:2002, *Geometrical product specifications (GPS) — Standard reference temperature for geometrical product specification and verification*

ISO/R 286:1962, *ISO system of limits and fits — Part I: General, tolerances and deviations*

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 286-2:1988/Cor 1:2006

ISO 370:1975, *Toleranced dimensions — Conversion from inches into millimetres and vice versa*

ISO 406:1987, *Technical drawings — Tolerancing of linear and angular dimensions*

ISO/R 463:1965, *Dial gauges reading in 0,01 mm, 0,001 in and 0,000 1 in*

ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements*

ISO 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*

ISO 1101:2004, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 1119:1975, *Series of conical tapers and taper angles*

ISO 1119:1998, *Geometrical product specifications (GPS) — Series of conical tapers and taper angles*

ISO 1829:1975, *Selection of tolerance zones for general purposes*

ISO 1878:1983, *Classification of instruments and devices for measurement and evaluation of the geometrical parameters of surface finish*

ISO 1879:1981, *Instruments for the measurement of surface roughness by the profile method — Vocabulary*

ISO 1880:1979, *Instruments for the measurement of surface roughness by the profile method — Contact (stylus) instruments of progressive profile transformation — Profile recording instruments*

ISO/R 1938:1971, *ISO system of limits and fits — Part II: Inspection of plain workpieces*

ISO 1947:1973, *System of cone tolerances for conical workpieces from C = 1:3 to 1:500 and lengths from 6 to 630 mm*

ISO 2538:1974, *Limits and fits — Series of angles and slopes on wedges and prisms*

ISO 2538:1998, *Geometrical product specifications (GPS) — Series of angles and slopes on prisms*