TECHNICAL REPORT

ISO TR 14638

First edition
1995-12-15

Geometrical product specification (GPS) — Masterplan

Spécification géométrique des produits (GPS) — Schéma directeur

Reference number
ISO/TR 14638 1995(E)

Contents

Annexes

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, 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).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 14638, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 3, *Limits and fits*, and has been based on studies carried out by the Joint Harmonization Group of ISO/TC 3, *Limits and fits*, ISO/TC 10, *Technical drawings, product definition and related documentation*, Subcommittee SC 5, *Dimensioning and tolerancing*, and ISO/TC 57, *Metrology and properties of surfaces.*

The content of ISO/TR 14638 is the status of the standardization on Geometrical Product Specifications covered by the scopes of the above Technical Committees and Subcommittee.

Introduction

Geometrical Product Specifications, abbreviated GPS, defines - i.e. on an engineering drawing - the shape (geometry), dimensions and surface characteristics of a workpiece which ensure optimum functioning of the workpiece in question, together with the dispersion around the optimum where the function is still satisfactory.

The manufacturing will nevertheless produce workpieces which are not perfect and which will show some deviation from the optimum and from one another.

These workpieces will be measured in order to compare them with the specification.

There is a need to relate

- the workpiece imaginated by the designer,
- the workpiece as manufactured,
- the knowledge of the workpiece as measured - the actual workpiece.

To obtain this relationship and to allow mutual interpretation, standards have been developed in the field of GPS dealing with basic definitions, symbolic representation, measurement principles etc.

For many years, these GPS standards have been prepared by Technical Committees (TCs) within ISO and have been issued as soon as specific needs were emerging, but sometimes a global view was missing. This results in standards with a different approach and presentation, and sometimes with contradictions. There are also gaps between the standards.

Recognizing this fact the Joint Harmonization Group of ISO/TC 3, *Limits and fits*, ISO/TC 10/SC 5, *Dimensioning and tolerancing*, and ISO/TC 57, *Metrology and properties of surfaces* (abbreviated ISO/TC 3-10-57/JHG) tasked with the harmonization of the standards of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57, decided to structure the standards dealing with GPS according to a Masterplan which shall be used for future standardization.

Geometrical product specification (GPS) — Masterplan

1 Scope

This Technical Report establishes the overview of the international standardization of Geometrical Product Specification (GPS). It explains the concept of GPS and provides a Masterplan of GPS including the existing standards and standards to be issued in the field which is the responsibility of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57.

It also mentions GPS standards and standardization activities outside the field of responsibility of the above mentioned technical committees (TCs). This is done in order to give complete information about the status of international GPS standards. The non ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57 standards are only referred to as examples and do not intend to be a complete and exhaustive list of complementary GPS standards.

This Technical Report provides information to the industrial user of ISO GPS standards and to other TCs within ISO, which are using the content of GPS standards in their International Standards or are producing complementary ISO GPS standards, in order to improve the common understanding and use of GPS.

2 Concept of Geometrical Product Specifications

The concept of GPS:

- covers several kinds of standards, some are dealing with the fundamental rules of specification (*Fundamental GPS standards*), some are dealing with global principles and definitions (*Global GPS standards*), some are dealing directly with the geometric characteristics (*General* - and *Complementary GPS standards*), see figure 1.

- covers several kinds of geometric characteristics such as size, distance, angle, form, location, orientation, roughness, etc. (see chains of *General GPS standards* numbered 1 through 17 in figure 1).

- covers workpiece characteristics (tolerance classification) as results of several kinds of manufacturing processes and the characteristics of specific machine elements (see chains of *Complementary GPS standards* numbered A1 through A7 and B1 through B3 in figure 1).

- occurs at several steps in the development of a product: design, manufacturing, metrology, quality assurance, etc.

The concept is graphically illustrated on figure 1 indicating four different types of GPS standards, which in total is designated the *GPS matrix model.*

3 Definitions

For the purpose of this Technical Report the following definitions applies:

3.1 ***chain of standards*** : All related standards concerning the same geometrical characteristics.

NOTE 1 - *Chains of standards* applies only to the *General GPS standards* and the *Complementary GPS standards.*

NOTE 2 - A *chain of standards* is characterized by the fact that each single standard, which is a part of a link in the chain, affects the other standards, so that the full understanding and application of each standard requires the knowledge of the other standards in the chain.

NOTE 3 - The task of all the *chains of standards* is to link - unambiguously - the indication on the drawing (e.g. the surface roughness symbol) to the SI unit of length in such a way that the tolerance limits are defined in every case possible - irrespective of the deviations from ideal geometry of the toleranced features, and other deviations from theoretical correct conditions - whatever they might be.

NOTE 4 - Each single standard in a *chain of standards* often aims at a limited and special group of users when considering the title of a standard or the subject of the standard mentioned in the subtitles. It is a common opinion that specific standards either belong to the design (department), the manufacturing or to the quality assurance (measurement). The rationale is however, that each link of the chain of standards is necessary for all parties (i.e. design, production, quality control, measuring etc.) in order to make it possible to understand the full content of each single standard and the definitions mentioned in each single standard in the chain.

NOTE 5 - A *chain of standards* consists of six chain links (numbered 1 - 6). Each link in the chain of standards has a very special task of its own (for further information see 4).

3.2 ***GPS matrix model*** : Arrangement consisting of 4 different main groups of standards:

- *Fundamental GPS standards*
- *Global GPS standards*
- *General GPS standards*
- *Complementary GPS standards.*

NOTE 6 - All GPS standards fit into the *GPS matrix model* which form the GPS Masterplan.

3.2.1 ***fundamental GPS standards*** : Standards establishing the fundamental rules and procedures for the GPS dimensioning and tolerancing of workpieces and products. For the time being only the *Principle of Independency* (ISO 8015) is standardized. A list of these standards is in Annex A.

NOTE 7 - The *Fundamental GPS standards* are the responsibility of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57.

3.2.2 ***global GPS standards*** : Standards which cover or influence several or all chains of *General GPS standards* and *Complementary GPS standards.* A list of these standards is in Annex B.

NOTE 8 - The *Global GPS standards* are the responsibility of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57.

3.2.3 ***general GPS matrix*** : Arrangement consisting of the chains of *General GPS standards.*

To illustrate the different aspects and relationships of these *General GPS standards,* the matrix of chains of general GPS standards in figure 2 has been defined where the rows are dealing with the different geometrical characteristics and the columns are dealing with the technical issues and requirements, necessary for ensuring a common and unambiguous understanding. Each matrix cell in every chain of standards has to be covered by the content of at least one standard.

NOTE 9 - The order according to which the columns (chain links) of the matrix are presented is based on the natural sequence for users reading a drawing and thus understand the drawing code. It shall be noticed that the concept (i.e. the definition of characteristics or parameters of a workpiece (actual feature definitions) for each chain of standards) is given in column no. 3.

NOTE 10 - The order according to which the lines of the matrix in figure 2 are presented does not imply any priority or precedence.

3.2.3.1 ***general GPS standards*** : The main body of GPS standards which establishes rules for drawing indications, definitions and verification principles for different types of geometrical characteristics.

A list of these standards is in Annex C.

NOTE 11 - The *General GPS standards* are the responsibility of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57.

3.2.4 ***complementary GPS matrix*** : Arrangement consisting of the chains of *Complementary GPS standards.*

Complementary GPS standards can be arranged in chains of standards analogous to the arrangement of the *General GPS standards* illustrated in figure 2.

3.2.4.1 ***complementary GPS standards*** : Standards establishing complementary rules for drawing indications, definitions and verification principles for a specialized category of features or elements. These rules depend on the type of manufacturing process and/or the type of machine element itself.

Complementary GPS standards are categorized as:

- **Process specific tolerance standards** (e.g. machining, casting, etc.)

NOTE 12 - Process specific tolerance standards are partly (chain A1 and A2 in figure 1) the responsibility of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57.

- **Machine element geometry standards** (e.g. screw threads, gears and splines)

NOTE 13 - Machine element geometry standards are not the responsibility of ISO/TC 3, ISO/TC10/SC5, and ISO/TC 57.

A list of these standards is in Annex D (Process specific tolerance standards) and in Annex E (Machine element geometry standards).

4 Setup and content of chain links

The chain links are titled and has the following defined tasks in the chain of standards.

4.1 ***Chain link no. 1 - Product documentation indication - Codification*** : Group of *General GPS standards* dealing with the drawing indication of the characteristic of the work piece are placed in this chain link. The indication is often in a sort of "coded" symbol - a symbolic representation of the geometric characteristic. The standards define the symbols , how to use the symbol and the associated rules of "grammar", the small differences in the symbol, which causes a major shift in meaning.

4.2 ***Chain link no. 2 - Definition of tolerances - Theoretical definition and values*** : Group of *General GPS standards* defining the numerical values related to the "code"-symbols, are placed in this chain link. The standards define the rules of translating from the code to "human understandable" (verbal) and "computer understandable" (mathematical) values into SI-units e.g. the size in mm - and vice versa.

Also the derivation of the characteristic from the geometry is placed in this chain link. These standards defines the theoretically exact feature with associated tolerances.

NOTE 14 - In some cases the theoretical limit values as defined in chain link no. 2 (e.g. defined in ISO 286 and ISO 1302) may be refined by the detailed requirements given under chain link 4 (e.g. ISO/R 1938 and ISO 4288).

4.3 ***Chain link no. 3 - Definitions for actual feature - characteristic or parameter*** : Group of *General GPS standards* with the purpose to make the supplementary definitions to extend the meaning of the theoretically exact feature, so that also the non-ideal real world geometry (actual feature characteristic) always is unambiguous defined in relation to the tolerance indication (code symbol) on the drawing. The definitions of actual feature characteristics in this chain link is based on sets of data points. The actual feature shall be defined in a verbal formulation and in a mathematical expression to oblige the human understanding of the definition as well as the computerized calculations.

NOTE 15 - The various functional requirements for geometric features may result in a need for a number of different definitions for actual features or actual feature characteristics. If this is the case the *chain of standards* shall be split up into a corresponding number of sub-chains of standards in chain link 3, 4, 5 and 6. This is not illustrated in this issue of ISO/TR 14638.

NOTE 16 - One of the sub-chains of standards shall be chosen as the default definition of the actual feature. The method of indication of the other sub-chain will be developed.

4.4 ***Chain link no. 4 - Assessment of the deviations of the workpiece - Comparison with tolerance limits*** : Group of *General GPS standards* that defines the detailed requirements for the assessment of the deviations of the workpiece from the one indicated on the drawing, taking into account the definitions in chain link 2 and 3.

NOTE 17 - The standards must state the detailed rules how to compare the measurement results with the tolerance limits to be able to prove conformance or non conformance of the workpiece with respect to the indicated geometric characteristics and its associated tolerance on the drawing, taking into account the uncertainty of the inspection or measuring process involved.

NOTE 18 - The infinite set of data points in the chain link 3 definition of the actual feature may be changed by convention to a limited set of data points. In this case the chain link 4 standard is defining the conventional true value of the indicated GPS characteristic on the drawing.

NOTE 19 - In some cases the theoretical limit values as defined in chain link no. 2 (e.g. defined in ISO 286 and ISO 1302) may be refined by the detailed requirements given under chain link 4 (e.g. ISO/R 1938 and ISO 4288).

4.5 ***Chain link no. 5 - Measurement equipment requirements*** : Group of *General GPS standards* describing specific measuring equipment or types of measuring instruments. The standards define the characteristics of measuring equipment, which are influencing the uncertainty of the measuring process in which the equipment is involved. The standards may include values for limits of maximum permissible error for the defined characteristics of measuring equipment.

NOTE 20 - Measuring equipment may be specific to one or more of the sub-chains of standards or may be universal and fit a number or several actual feature definitions in the chain of standards.

NOTE 21 - A valuable task of this chain link is the harmonizing effect on the market of measuring equipment.

4.6 Chain link no. 6 - Calibration requirements - Measurement standards : Group of *General GPS standards* describing/defining the calibration standards and the calibration procedures to be used, verifying functional requirements of the specific measuring equipment (limits of permissible error) in chain link number 5, with traceability to the definition of the SI unit concerned - e.g. the meter.

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 defects** 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 **Casting** 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
A1. 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 1: The GPS matrix model - GPS Masterplan - Overview

5 Masterplan in the field of Geometrical Product Specifications - GPS

The GPS masterplan (GPS matrix model) in figure 1 and the compressed General GPS matrix defined in figure 2 shall be used to decide how the needs for standardization shall be solved, i.e. future standards shall fit into the structure and the matrix to clarify their scope and relationship with other standards.

To help the future needs for standardization in the field of general GPS standards, the expanded matrix of figure 3 includes standards already existing and standards under development in the field of general GPS; and shows the gaps to be filled. These standards are referred to by their ISO issue number or, for standards not yet having an ISO number a preliminary (unofficial) number XXXYY has been used. The YYs are serial numbers which only fulfil the needs for information in this Technical Report and does not represent any relationship to official catalogues of ISO Central Secretariat.

Chain link number		1	2	3	4	5	6
Geometrical characteristic of feature		Product documentation indication - Codification	Definition of tolerances - Theoretical definition and values	Definitions for actual feature - characteristic or parameter	Assessment of the deviations of the workpiece - Comparison with tolerance limits	Measurement equipment requirements	Calibration requirements - Measurements standards
1	Size						
2	Distance						
3	Radius						
4	Angle (tolerance in degrees)						
5	Form of a line independant of a datum						
6	Form of a line dependent of a datum						
7	Form of a surface independent of a datum						
8	Form of a surface dependent of a datum						
9	Orientation						
10	Location						
11	Circular run out						
12	Total run out						
13	Datums						
14	Roughness profile						
15	Waviness profile						
16	Primary profile						
17	Surface defects						
18	Edges						

Figure 2 - The compressed "General GPS matrix" - part of the field of responsibility of ISO/TC3, ISO/TC10/SC5 and ISO/TC57 (see figure 3 for the complete "General GPS matrix").

For the future work of ISO/TC 3, ISO/TC 10/SC 5 and ISO/TC 57 the following 3 rules will apply for the preparation of GPS standards:

5.1 ***The rule of unambiguity***: Each chain of standards, assisted by *Global GPS standards*, shall include the necessary definitions and rules, that unambiguity exists between the drawing indication and the geometrical characteristics of the workpiece and that the assessed value(s) representing the characteristic is (are) traceable to International physical calibration Standards

NOTE 22 - The *rule of unambiguity* is influencing the content of the standards in the various chains of standards and the *Global GPS standards*, and also ensures that each measurand in the chain is measurable.

5.2 *The rule of totality* : The *General GPS matrix* - consisting of individual chains of standards and assisted by the *Global GPS standards* - shall contain the necessary different possibilities that it is possible to indicate on the drawing of all the required geometrical characteristics.

5.3 *The rule of complementarity*: Each of the individual chains of standards shall be complementary to the other.

> **NOTE 23** - The *rule of totality* is influencing the number of chains of standard. The *rule of complementarity* ensures that the individual requirements on the drawing are independent of each other, that no unintended interference occurs between multiple requirements.

6 Lists of GPS standards

In the Annexes A through E the lists of GPS standards are given (existing standards and standards in various phases of development). The content is:

Annex A: Fundamental GPS standards
Annex B: Global GPS standards.
Annex C: General GPS standards.
Annex D: Complementary GPS standards - Process specific tolerance standards.
Annex E: Complementary GPS standards - Machine element geometry standards.

The lists of Annex A, B and C are complete and exhaustive at the time of issue of this Technical Report. They are indicating all published standards and all projects of ISO/TC 3, TC 10/SC 5 and TC 57. The lists of Annex D and E are not exhaustive.

The lists of Annex A - E have columns with the following indications and content:

Number: The ISO issue number for International Standards, Amendments, Recommendations and Technical Reports - in ascending order. For the purpose of this Technical Report, ISO documents not yet issue numbered are indicated by (XXXYY), where YY is a special serial number for this Technical Report only. A few ISO publications have no ISO number, but are indicated by the official abbreviation (i.e. VIM).

Status: Indication of the status of the document. *Standard, Amendment, Recommendation, Technical Report or Guideline* for published documents. All documents not yet edited and finalized (published) are indicated as *Projects*. If a document is under revision, it is indicated by (R). If a document is subject to withdrawal, it is indicated by (W).

Edition - Year: For published documents the edition number and edition year is indicated. For documents not yet edited and finalized the present status is indicated:

- \- Proposal - a first working draft is not yet distributed.
- WD Working draft in a TC (Technical Committee), SC (Sub Committee), WG (Working Group) or TG (Task Group)
- CD Committee draft
- DIS Draft International standard

Title: The full title of the published standard or the present working title of a WD, CD or DIS.

Pages: The number of pages in the document. The number of pages is not indicated for not yet published documents.

TC/SC: The Technical Committee and the Sub Committee responsible for the publication or project. In some cases documents are mentioned other than those originating from normal ISO/TCs. These are indicated in bold typeface.

GLOBAL GPS STANDARDS			
1, 370, 10209-3, 10579, VIM, GUM			

GENERAL GPS STANDARDS				
Chain link number			**1**	**2**
Geometrical characteristic of feature	**Geometric sub-characteristic of feature or parameters**		**Product documentation indication - Codification**	**Definition of tolerances - Theoretical definition and values**
Size			129 (R), 286-1, 406-1	286-1, 286-2, 1829
Distance	"Step" distance (height)		129 (R), 406	
	Distance between real or derived feature and derived feature		129 (R), 406	
Radius			129 (R)	
Angle (tolerance in degrees)	Angle between real features		129 (R), 1119 (R)	
	Angle between real or derived and derived feature		129 (R)	
Form of line independent of datum	Real feature (line)	Profile any line	1101 (R), 1660 (R)	1101 (R), 1660 (R)
		Straightness	1101 (R)	1101 (R), ¤12780-1
		Roundness	1101 (R)	1101 (R), 6318 (W)
	Derived feature (line)	Profile any line	1101 (R), 1660 (R)	1101 (R), 1660 (R)
		Straightness	1101 (R), 2692 (R)	1101 (R)
		Roundness	1101 (R)	1101 (R)
Form of line dependant of datum	Real feature (profile of any line)		1101 (R), 1660 (R)	1101 (R), 1660 (R)
	Derived feature (profile of any line)		1101 (R), 1660 (R)	1101 (R), 1660 (R)
Form of surface independent of datum	Real feature	Profile any surface	1101 (R), 1660 (R)	1101 (R), 1660 (R)
		Flatness	1101 (R)	1101 (R)
		Cylindricity	1101 (R)	1101 (R)
		Cones	1101 (R), 3040	1101 (R), 3040
	Derived feature	Profile any surface	1101 (R)	1101 (R)
		Flatness	1101 (R), 2692 (R)	1101 (R)
Form of surface dependant of datum	Real feature	any surface	1101 (R), 1660 (R)	1101 (R), 1660 (R)
		Cones	1101 (R), 3040	1101 (R), 3040
	Derived feature		1101 (R)	1101 (R)

¤ = ISO draft standard in progress (WD, CD or DIS) XXXYY = ISO number not yet known (numbered YY)

Figure 3.1: Global GPS standards and the General GPS matrix

GLOBAL GPS STANDARDS			
1, 370, 10209-3, 10579, VIM, GUM			
	¤14253-1, ¤-2	¤14253-1, ¤-2	¤14253-1, ¤-2

GENERAL GPS STANDARDS				
3	**4**		**5**	**6**
Definitions for actual feature-characteristic or parameter	**Assessment of the deviations of the workpiece - Comparison with tolerance limits**		**Measurement equipment requirements**	**Calibration requirements - Calibration standards**
286-1, 1938 (R) 8015 (R) ¤14660-1, ¤-2	Limit gauges	1938 (R)	1938 (R), 3670 (R)	1938 (R), 3670 (R)
	Indicating measuring instruments	1938 (R)	463 (R), 3599 (R), 3611, ¤9121, 6906 (W) (R), ¤9493, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤13385, ¤XXX01, ¤XXX19	3650 (R)
			463 (R), 3599 (R), 6906 (R), 7863, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤13385	
			7863, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤13385	
			¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
8015			¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
			¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤12780-1	5460, ¤12780-2		463 (R), 8512-1, 8512-2, ¤9493, (¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6), ¤12780-3, XXX19	¤12780-4
¤12181-1	5460, ¤12181-2		463 (R), 4291 (W), 4292 (W), ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤12181-3	¤12181-4
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
			¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤12781-1	5460, ¤12781-2		463 (R), 8512-1, 8512-2, ¤9493, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤12781-3, XXX19	¤12781-4
¤12180-1	5460, ¤12180-2		463 (R), ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, ¤12180-3	¤12180-4
			463 (R), 3611, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
			463 (R), ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460		¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	

(R) ≈ Revision in progress (W) ≈ To be with drawn

Figure 3.2: Global GPS standards and the General GPS matrix

GLOBAL GPS STANDARDS			
1, 370, 10209-3, 10579, VIM, GUM			

GENERAL GPS STANDARDS					
Chain link number				**1**	**2**
Geometrical characteristic of feature		**Geometric sub-characteristic of feature or parameters**		**Product documentation indication - Codification**	**Definition of tolerances - Theoretical definition and values**
Orientation		Real feature (line or plane)	Parallelism (0°)	1101 (R)	1101 (R)
			Perpendicularity (90°)	1101 (R)	1101 (R)
			Angularity	1101 (R)	1101 (R)
		Derived feature	Parallelism (0°)	1101 (R), 2692 (R), 10578	1101 (R), 10578
			Perpendicularity (90°)	1101 (R), 2692 (R), 10578	1101 (R), 10578
			Angularity	1101 (R), 2692 (R), 10578	1101 (R), 10578
Location		Real feature	Position	1101 (R), 5458 (R)	1101 (R), 5458 (R)
		Derived feature	Position	1101 (R), 2692 (R), 5458 (R), 10578	1101 (R), 5458 (R), 10578
			Coaxiality	1101 (R), 2692 (R), 10578	1101 (R), 10578
			Concentricity	1101 (R), 2692 (R), 10578	1101 (R), 10578
			Symmetry	1101 (R), 2692 (R), 10578	1101 (R), 10578
Circular run out				1101 (R)	1101 (R)
Total run out				1101 (R)	1101 (R)
Datums		Datums	Datums associated with real features	1101 (R), 5459	5459
			Datums associated with derived features	1101 (R), 2692 (R), 5459	5459
		Datum targets		1101 (R), 5459	5459
		Datum systems		1101 (R), 5459	5459
Surface Texture	**Roughness profile**	M-System - Ra, Rz, ...		1302	468 (W), 4287/1 (R), 4287/2, ¤11562
		M-System - S, Sm, Tp		1302	468 (W), 4287-1 (R), ¤11562
		Motif method - R, Rx, AR		1302	¤12085
		Rk, Rpk, Rvk, Rm1k, Rm2k		1302	¤11562, ¤13565-1, ¤13565-2
		Rpq, Rvq, Rmq		1302	¤11562, ¤13565-1, ¤13565-3
		Areal characteristics			
	Waviness profile	M-system - Wa, Wz, ...		1302	4287-1 (R), ¤11562
		Motif method - W, AW, Wx, Wte		1302	¤12085
	Primary profile	M-System - Pa, Pt, ...		1302	4287-1 (R), ¤11562
	Surface defects			¤8785	¤8785
Edges				13715	13715

¤ = ISO draft standard in progress (WD, CD or DIS) XXXYY = ISO number not yet known (numbered YY)

Figure 3.3: Global GPS standards and the General GPS matrix

GLOBAL GPS STANDARDS			
1, 370, 10209-3, 10579, VIM, GUM			
	¤14253-1, ¤-2	¤14253-1, ¤-2	¤14253-1, ¤-2

GENERAL GPS STANDARDS			
3	**4**	**5**	**6**
Definitions for actual feature characteristic or parameter	**Assessment of the deviations of the workpiece - Comparison with tolerance limits**	**Measurement equipment requirements**	**Calibration requirements - Calibration standards**
	5460	463 (R), 8512-1, -2, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460	463 (R), ¤10360-1,10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460	463 (R), ¤10360-1,10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460	463 (R), ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
¤14660-1, ¤-2	5460	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6	
	5460	463 (R), ¤9493, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX19	
	5460	463 (R), ¤9493, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX19	
5459, XXX26	5460, XXX27	463 (R), 8512-1, -2, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX28	
5459, XXX26	5460, XXX27	¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX28	
5459, XXX26	5460, XXX27	8512-1, -2, ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX28	
5459, XXX26	5459, XXX27	463 (R), ¤10360-1, 10360-2, ¤-3, ¤-4, ¤-5, ¤-6, XXX28	
4288 (R), ¤11562	2632-1 (W), -2 (W), 4288 (R)	1878, 1879 (W), 1880 (W), 2632-1 (W), -2 (W), 3274 (R), ¤11562	2632-1 (W), -2 (W), 5436 (R), ¤12179
4288 (R), ¤11562	4288 (R)	3274 (R), ¤11562	5436 (R), ¤12179
¤12085	4288 (R), ¤12085	3274 (R)	5436 (R), ¤12179
¤11562, ¤13565-2	4288 (R)	1880 (W), 3274 (R), ¤11562	5436 (R), ¤12179
¤11562, ¤13565-2	4288 (R)	1880 (W), 3274 (R), ¤11562	5436 (R), ¤12179
¤11562	4288 (R), ¤12085	1880 (W), 3274 (R), ¤11562	5436 (R), ¤12179
¤12085		3274 (R)	5436 (R), ¤12179
4288 (R)		3274 (R), ¤11562	

(R) = Revision in progress (W) = To be with drawn

Figure 3.4: Global GPS standards and the General GPS matrix

Annex A

Fundamental GPS Standards

Number	Status	Edition year	Title	Pages	TC/SC
8015	Standard (R)	1., 1985	Technical drawings - Fundamental tolerancing principle.	5	10/5
14638	Techn. Rep.	1., 1995	Geometrical Product Specifications (GPS) - Masterplan	28	JHG
14659	Project	WD	Geometrical Product Specifications (GPS) - Fundamental principles - Principle of Independency	8	JHG

Annex B

Global GPS Standards

Number	Status	Edition year	Title	Pages	TC/SC
1	Standard	1., 1975	Standard reference temperature for industrial length measurements	1	3
370	Standard	1., 1975	Toleranced dimensions - Conversions from inches into mm and vice versa	6	3
10209-3	Project	WD	Technical product documentation. Vocabulary - Part 3: Terms related to dimensioning and tolerancing	14	10/1
10579	Standard	1., 1993	Technical drawings - Dimensioning and tolerancing - non rigid parts	3	10/5
14253-1	Project	DIS	Geometrical Product Specification (GPS) - Inspection by measurement of workpieces and measuring instruments - Decision rules for proving conformance or non conformance with specification	10	3/TG1
14253-2	Project	WD	Geometrical Product Specification (GPS) - Guide to the estimation of uncertainty of measurement in calibration of measuring equipment and product verification	-	3
VIM	Guideline	2., 1993	International vocabulary of basic and general terms in metrology	59	TAG4/WG1
GUM	Guideline	1., 1993	Guide to the expression of uncertainty in measurement	108	TAG4/WG3
XXX21	Project	-	Measurement equipment requirements - "Horizontal standard"	-	3/3
XXX30	Project	-	Floating zero	-	3/3

Annex C

General GPS Standards

Number	Status		Edition year	Title	Pages	TC/SC
129	Standard	(R)	1., 1985	Technical drawings - Dimensioning - General principles, definitions, methods of execution and special indications.	12	10/1
286-1	Standard		1., 1988	ISO system of limits and fits - Part 1: Basis of tolerances, deviations and fits.	30	3
286-2	Standard		1., 1988	ISO system of limits and fits - Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.	43	3
406	Standard		2., 1987	Technical drawings - Tolerancing of linear and angular dimensions.	4	10/1
463	Recomm.	(R)	1., 1965	Dial gauges reading in 0,01 mm, 0,001 inch and 0,0001 Inch	4	3/3
468	Standard		1., 1982	Surface Roughness - Parameters their values and general rules for specifying requirements	4	57/1
1101	Standard	(R)	1., 1983	Technical drawings - Geometrical tolerancing - Tolerances of form, orientation, location and run-out - Generalities, definitions, symbols, indication on drawings	33	10/5
1101	Extract	(R)	1., 1983	Technical drawings - Geometrical tolerancing - Toleranced characteristics and symbols - Examples of indication and interpretation	1	10/5
1119	Standard	(R)	1., 1975	Series of conical tapers and angles	3	3
1302	Standard		3., 1992	Technical drawings - Method of indicating surface texture	16	10/1
1829	Standard		1., 1975	Selection of tolerance zones for general purposes.	2	3
1660	Standard	(R)	2., 1987	Technical drawings - Dimensioning and tolerancing of profiles	5	10/5

1878	Standard	(R)	2., 1983	Classification of instruments and devices for measurement and evaluation of the geometrical parameters of surface finish	2	57/1
1879	Standard	(R)	2., 1981	Instruments for the measurement of surface roughness by the profile method - Vocabulary	1	57/1
1880	Standard	(R)	2., 1979	Instruments for the measurement of surface roughness by the profile method - Contact (stylus) instruments of progressive profile transformation - Profile recording instruments	4	57/1
1938	Recomm.	(R)	1., 1971	ISO system of limits and fits - Part II: Inspection of plain workpieces.	26	3
2538	Standard	(R)	1., 1974	Limits and fits - Series of angles and slopes on wedges and prisms	5	3
2632-1	Standard	(W)	2., 1985	Roughness comparison Specimens - Part 1: Turned, ground, bored, milled, shaped and planed	4	57/2
2632-2	Standard	(W)	2., 1985	Roughness comparison Specimens - Part 2: Spark-eroded, shot-blasted and grit-blasted, and polished	4	57/2
2692	Standard	(R)	1., 1988	Technical drawings - Geometrical tolerancing - Maximum material principle	21	10/5
2692-AMD1	Amendment	(R)	1., 1992	Technical drawings - Geometrical tolerancing - Maximum material principle - AMENDMENT 1: Least material requirement	-	10/5
3040	Standard		2., 1990	Technical drawings - Dimensioning and tolerancing - Cones	6	10/1
3274	Standard	(R)	1., 1975	Instruments for the measurement of surface roughness by the profile method - Contact (stylus) instruments of consecutive profile transformation - Contact profile meters, system M	7	57/1
3274	Project		DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Nominal characteristics of contact stylus instruments	15	57/1
3599	Standard	(R)	1., 1976	Vernier callipers reading to 0,1 and 0,05 mm. New ISO No. 13365	4	3/3
3611	Standard		1., 1978	Micrometer callipers for external measurement.	6	3/3
3650	Standard	(R)	1., 1978	Gauge Blocks.	9	3/3

3670	Standard	(R)	1., 1979	Blanks for plug gauges and handles (taper lock and trilock) and ring gauges - Design and general dimensions.	17	3
3670	Project		DIS	Blanks for plug gauges and handles (taper lock and trilock) and ring gauges - Design and general dimensions.	17	3
4287/1	Standard	(R)	1., 1984	Surface roughness - Terminology - Part 1: Surface and its parameters	25	57/1
4287-1	Project		DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Part 1: Surface Terms, definitions and parameters of surface texture	16	57/1
4287/2	Standard		1., 1984	Surface roughness - Terminology - Part 2: Measurement of surface roughness parameters	5	57/1
4288	Standard	(R)	1., 1985	Rules and the procedures for the measurement of surface roughness using stylus instruments	6	57/1
4288	Project		DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Rules and procedures for the assessment of surface texture	10	57/1
4291	Standard	(R)	1., 1985	Methods for the assessment of departure from roundness - Measurement of variations in radius	18	57/3
4292	Standard	(R)	1., 1985	Methods for the assessment of departure from roundness - Measurement by two- and three-point methods	8	57/3
5436	Standard	(R)	1., 1985	Calibration specimens - Stylus instruments - Types, calibration and use of specimens	20	57/2
5458	Standard	(R)	1., 1987	Technical drawings - Geometrical tolerancing - Positional tolerancing	11	10/5
5459	Standard	(R)	1., 1981	Technical drawings - Geometrical tolerancing - Datums and datum systems for geometrical tolerances	16	10/5
5460	Techn.Report		1., 1985	Technical drawings - Geometrical tolerancing - Tolerancing of form, orientation, location and run-out - Verification principles and methods - Guidelines	71	10 (57)
6318	Standard	(R)	1., 1985	Measurement of roundness - Terms, definitions and parameters of roundness	5	57/3
6906	Standard	(R)	1., 1984	Vernier callipers reading to 0,02 mm. (Under revision, as ISO 13365)	5	3/3

7863	Standard		1., 1984	Height setting micrometers and riser blocks.	21	3
8015	Standard	(R)	1., 1985	Technical drawings - Fundamental tolerancing principle.	5	10/5
8512-1	Standard		1., 1990	Surface plates - Part 1: Cast iron.	11	3
8512-2	Standard		1., 1990	Surface plates - Part 2: Granite.	12	3
8785	Project		DIS	Surface defects - Vocabulary	-	57
9121	Project		CD	Internal micrometers with two point contact	-	3/3
9493	Project		CD	Dial test indicators - Lever type	-	3/3
10360-1	Project		Draft TR	Coordinate metrology - Part 1: Definitions, geometrical fundamental principles.	-	3/WG10
10360-2	Standard		1., 1994	Coordinate metrology - Part 2: Machine performance and verification.	9	3/WG10
10360-3	Project		DIS	Coordinate metrology - Part 3: Performance test for CMMs with a rotary tabel as the fourth axis	-	3/WG10
10360-4	Project		CD	Coordinate metrology - Part 4: Performance test for CMMs used in scanning mode	-	3/WG10
10360-5	Project		CD	Coordinate metrology - Part 5: Performance test for CMMs used with multiple stylus set ups	-	3/WG10
10360-6	Project		WD	Coordinate metrology - Part 6: Performance test for CMMs. Conformance testing of software of geometrical element assessment	-	3/WG10
10578	Standard		1., 1992	Technical drawings - Tolerancing of orientation and location - Projected tolerance zone	3	10/5
11562	Project		DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Metrological characterics of phase correct filters	8	57/1
12085	Project		DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Motif method for measurement of surface roughness and waviness	13	57/1
12179	Project		WD	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Calibration of instruments for the measurement of surface roughness.	-	57/2

12180-1	Project	WD	Geometrical Product Specifications (GPS) - Cylindricity - Part 1: Terms, definitions and parameters of cylindricity	-	57/3
12180-2	Project	WD	Geometrical Product Specifications (GPS) - Cylindricity - Part 2: Rules and procedures for the assessment of deviations from cylindricity	-	57/3
12180-3	Project	WD	Geometrical Product Specifications (GPS) - Cylindricity - Part 3: Instruments for the assessment of deviations from cylindricity	-	57/3
12180-4	Project	WD	Geometrical Product Specifications (GPS) - Cylindricity - Part 4: Calibration	-	57/3
12181-1	Project	DIS	Geometrical Product Specifications (GPS) - Roundness - Part 1: Vocabulary	-	57/3
12181-2	Project	DIS	Geometrical Product Specifications (GPS) - Roundness - Part 2: Instruments for the determination of departure from roundness - Vocabulary and specification	-	57/3
12181-3	Project	DIS	Geometrical Product Specifications (GPS) - Roundness - Part 3: Determination of the departure from roundness	-	57/3
12181-4	Project	WD	Geometrical Product Specifications (GPS) - Roundness - Part 4: Calibration specimens for instruments for the determination of departure from roundness - specification and test methods for the calibration of instruments and specimens	-	57/3
12780-1	Project	-	Geometrical Product Specifications (GPS) - Straightness - Part 1: Terms, definitions and parameters of straightness	-	57/3
12780-2	Project	-	Geometrical Product Specifications (GPS) - Straightness - Part 2: Rules and procedures for the assessment of deviations from straightness	-	57/3
12780-3	Project	-	Geometrical Product Specifications (GPS) - Straightness - Part 3: Instruments for the assessment of deviations from straightness	-	57/3
12780-4	Project	-	Geometrical Product Specifications (GPS) - Straightness - Part 4: Calibration	-	57/3
12781-1	Project	-	Geometrical Product Specifications (GPS) - Flatness - Part 1: Terms, definitions and parameters of flatness	-	57/3

12781-2	Project	-	Geometrical Product Specifications (GPS) - Flatness - Part 2: Rules and procedures for the assessment of deviations from flatness	-	57/3
12781-3	Project	-	Geometrical Product Specifications (GPS) - Flatness - Part 3: Instruments for the assessment of deviations from flatness	-	57/3
12781-4	Project	-	Geometrical Product Specifications (GPS) - Flatness - Part 4: Calibration	-	57/3
13385	Project	CD	Vernier, dial and digital callipers and depth gauges	-	3/3
13565-1	Project	DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Characterization of surfaces having stratified functional properties - Part 1: Filtering and general measuring conditions	5	57/1
13565-2	Project	DIS	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Characterization of surfaces having stratified functional properties - Part 2: Height Characterization using linear material ratio curve	6	57/1
13565-3	Project	CD	Geometrical Product Specifications (GPS) - Surface texture - Profile method - Characterization of surfaces having stratified functional properties - Part 3: Height Characterization using the material probability curve of surfaces consisting of two vertical random components	-	57/1
13715	Standard	1., 1994	Technical drawings - Corners - Vocabulary and indication on drawings	13	10/6
14660-1	Project	WD	Geometrical Product Specifications (GPS) - Geometric features - Part 1: General definitions	4	JHG
14660-2	Project	WD	Geometrical Product Specifications (GPS) - Geometric features - Part 2: Definitions of actual derived axis of a cylinder and a cone; Actual derived median face; Actual local size, diameter and distance	8	JHG
XXX01	Project	WD	Dimensional measuring instruments - Height gauges	-	3/3
XXX09	Project	WD	Functional gauges	-	3
XXX17	Project	WD	Vectorial tolerancing	-	10/5
XXX18	Project	-	Reference plugs and rings	-	3

20	XXX19	Project	-	Electrical length measuring instruments	-	3
	XXX23	Project	-	Mathematization of Geometrical Tolerances	-	10/5
	XXX25	Project	-	Areal characterization of Surface Roughness	-	57
	XXX26	Project	-	Datums - Part 1: Terms, definitions of datums	-	ISO/JHG
	XXX27	Project	-	Datums - Part 2: Rules and procedures for the assessment of datums	-	ISO/JHG
	XXX28	Project	-	Datums - Part 3: Instruments for the assessment of datums	-	ISO/JHG

Annex D

Complementary GPS Standards

Process specific tolerance standards

The standards mentioned in this annex may not be exhaustive. The standards and the mentioned production processes are to be taken as examples. Only the standards which are the responsibility of ISO TC3, TC10 and TC 57 are all mentioned.

1 Machining

Number	Status	Edition year	Title	Pages	TC/SC
2768-1	Standard	1., 1989	General tolerances - Part 1: Tolerances for linear and angular dimensions without individual tolerance indications.	3	3
2768-2	Standard	1., 1989	General tolerances - Part 2: Geometrical tolerances for features without individual tolerance indications	8	3

2 Casting

Number	Status	Edition year	Title	Pages	TC/SC
8062	Standard	2., 1994	Castings - System of dimensional tolerances and machining allowances	13	3
10135	Standard	1., 1994	Technical drawings - Simplified representation of moulded, cast and forged parts	9	10/6
XXX24	Project	-	Castings - System of Geometrical tolerances	-	3

3 Welding

Number	Status	Edition year	Title	Pages	TC/SC
13920-1	Project	WD	Welding - General tolerances for welded structures - Part 1: Dimension for length and angles	4	44
13920-2	Project	WD	Welding - General tolerances for welded structures - Part 2: Shape and position	-	44

4 Thermal cutting

Number	Status	Edition year	Title	Pages	TC/SC
9013	Standard	1., 1992	Welding and allied processes - Quality classification and dimensional tolerances of thermally cut (oxygen/fuel gas flame) surfaces	9	44/8

5 Plastic moulding

Number	Status	Edition year	Title	Pages	TC/SC

6 Metallic and inorganic coating

Number	Status	Edition year	Title	Pages	TC/SC
1460	Standard	2., 1992	Metallic coatings - Hot dip galvanized coatings on ferrous materials - Determination of the mass per unit area - Gravimetric method	2	107

1463	Standard	2., 1982	Metallic and oxide coatings - Measurement of coating thickness - Microscopical method	5	107
2064	Standard	2., 1980	Metallic and other non-organic coatings - Definitions and conventions concerning the measurement of thickness	2	107
2106	Standard	2., 1982	Anodizing of aluminum and its alloys - Determination of mass per unit area (surface density) of anodic oxide coatings - Gravimetric method. Amendment 1 1983, 1 page.	2	79
2128	Standard	1., 1976	Anodizing of aluminum and its alloys - Determination of mass per unit area of anodic oxide coatings - Non destructive measurement by split-beam microscope	2	79
2177	Standard	2., 1985	Metallic coatings - Measurement of coating thickness - Coulometric method by anodic dissolution	9	107
2178	Standard	2., 1982	Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method	4	107
2360	Standard	2., 1982	Non-conductive coatings on magnetic basis metals - Measurement of coating thickness -eddy current method	3	107
2361	Standard	2., 1982	Electrodeposited nickel coating on magnetic and non-magnetic substrates - Measurement of coating thickness - Magnetic method	4	107
3160-2	Standard	2., 1992	Watch cases and accessories - Gold alloy coverings - Part 2: Determination of fineness, thickness and corrosion resistance	9	114
3497	Standard	2., 1990	Metallic coatings - Measurement of coating thickness - X-ray spectrometric methods	11	107
3543	Standard	1., 1981	Metallic and non-metallic coatings - measurement of thickness - Beta backscatter method	9	107
3868	Standard	1., 1976	Metallic and other non-organic coatings - Measurement of coating thicknesses - Fizeau multiple-beam interferometry method	45	107
3882	Standard	2., 1986	Metallic and other non-organic coatings - review of methods of measurement of thickness	5	107
3892	Standard	1., 1980	Conversion coatings on metallic materials - Determination of coating mass per unit area - Gravimetric method	3	107

4518	Standard	1., 1980	Metallic coatings - Measurement of coating thickness - Profilometric method	4	107
4522-1	Standard	1., 1985	Metallic coatings - Test methods for electrodeposited silver and silver alloy coatings - part 1: Determination of coating thickness	2	107
4524-1	Standard	1., 1985	Metallic coatings - Test methods for electrodeposited gold and gold alloy coatings - part 1: Determination of coating thickness	5	107
7668	Standard	1., 1986	Anodized aluminium and aluminium alloys - Measurement of specular reflectance and specular gloss at angles of 20 degrees, 45 degrees, 60 degrees or 85 degrees	10	79
7759	Standard	1., 1983	Anodized aluminium and aluminium alloys - Measurement of reflectivity characteristics of aluminium surfaces using abridged goniophotometer or goniophotometer	5	79
9220	Standard	1., 1988	Metallic coatings - Measurement of coating thickness - Scanning electron microscope	5	107

7 Painting

Number	Status	Edition year	Title	Pages	TC/SC
2808	Standard	2., 1991	Paints and varnishes - Determination of film thickness	17	35
8503-1	Standard	1., 1988	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces	6	35
8503-2	Standard	1., 1988	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel - Comparator procedure	3	35

8503-3	Standard	1., 1988	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 3: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - Focusing microscope procedure	8	35
8503-4	Standard	1., 1988	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - Stylus instrument procedure	8	35

Annex E

Complementary GPS Standards

Machine element geometry standards

The standards mentioned in this annex may not be exhaustive. The standards and the mentioned machine elements are to be taken as examples.

1 Screw threads

Number	Status		Edition year	Title	Pages	TC/SC
7-1	Standard		3., 1994	Pipe threads where pressure tight joints are made on the threads - Part 1: Dimensions, tolerances and designation	7	5
7-2	Standard		1., 1982	Pipe threads where pressure tight joints are made on the threads - Part 2: Verification by means of limit gauges	9	5
68	Standard	(R)	1., 1973	ISO general purpose screw threads - basic profile	3	1
68-1	Project		CD	ISO general purpose screw threads - basic profile - Part 1: Metric thread	-	1
68-2	Project		CD	ISO general purpose screw threads - basic profile - Part 2: Inch thread	-	1
228-1	Standard		3., 1994	Pipe threads where pressure tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation	5	5

228-2	Standard		3., 1987	Pipe threads where pressure tight joints are not made on the threads - Part 2: Verification by means of limit gauges	13	5
261	Standard	(R)	1., 1973	ISO general purpose metric screw threads - General plan	3	1
261	Project		CD	ISO general purpose metric screw threads - General plan	-	1
262	Standard	(R)	1., 1973	ISO general purpose metric screw threads - Selected sizes for screws, bolts and nuts	1	1
262	Project		CD	ISO general purpose metric screw threads - Selected sizes for screws, bolts and nuts	-	1
263	Standard		1., 1973	ISO Inch screw threads - General plan and selection for screws, bolts and nuts - Diameter range 0,06 - 6 in.	5	1
724	Standard		2., 1993	ISO general-purpose metric screw threads - Basic dimensions	7	1
725	Standard		1., 1978	ISO inch screw threads - Basic dimensions	5	1
965-1	Standard	(R)	2., 1980	ISO general purpose metric screw threads - Tolerances - Part 1: Principles and basic data	11	1
965-1	Project		CD	ISO general purpose metric screw threads - Tolerances - Part 1: Principles and basic data	-	1
965-2	Standard	(R)	2., 1980	ISO general purpose metric screw threads - Tolerances - Part 2: Limits of sizes for general purpose bolt and nut threads - Medium quality	5	1
965-2	Project		CD	ISO general purpose metric screw threads - Tolerances - Part 2: Limits of sizes for general purpose bolt and nut threads - Medium quality	-	1
965-3	Standard	(R)	2., 1980	ISO general purpose metric screw threads - Tolerances - Part 3: Deviations for constructional threads	15	1
965-3	Project		CD	ISO general purpose metric screw threads - Tolerances - Part 3: Deviations for constructional threads	-	1

965-4	Project		CD	ISO general purpose metric screw threads - Tolerances - Part 4: Limits of sizes for hot-dip galvanized external threads to mate with internal threads tapped with tolerance position H or G after galvanizing	15	1
965-5	Project		CD	ISO general purpose metric screw threads - Tolerances - Part 5: Limits of sizes for hot-dip galvanized internal threads to mate with external threads with maximum size of tolerance position h before coating	15	1
1478	Standard		1., 1983	Tapping screw thread	2	2
1501	Standard	(R)	1., 1970	ISO miniature screw threads	12	1
1501	Project		CD	ISO miniature screw threads	12	1
1502	Standard	(R)	1., 1978	ISO general purpose screw threads - Gauging	22	1
1502	Project		DIS	ISO general purpose screw threads - Gauging	22	1
2901	Standard		2., 1993	ISO metric trapezoidal screw threads - Basic profile and maximum material profiles	5	1
2902	Standard		1., 1977	ISO metric trapezoidal screw threads - General plan	2	1
2903	Standard		2., 1993	ISO metric trapezoidal screw threads - Tolerances	10	1
2904	Standard		1., 1977	ISO metric trapezoidal screw threads - Basic dimensions	6	1
5408	Standard		1., 1983	Cylindrical screw threads - Vocabulary	10	1
5864	Standard		2., 1993	ISO inch screw threads - Allowances and tolerances	16	1
6410-1	Standard		1., 1993	Technical drawings - Representation of screw threads and threaded parts - Part 1: General conventions	6	10/6
6410-2	Standard		1., 1993	Technical drawings - Representation of screw threads and threaded parts - Part 2: Screw thread inserts	6	10/6
6410-3	Standard		1., 1993	Technical drawings - Representation of screw threads and threaded parts - Part 3: Simplified representation	6/6	10/6

2 Gears

Number	Status		Edition year	Title	Pages	TC/SC
53	Standard		1., 1974	Cylindrical gears for general and for heavy engineering - Basic rack	1	60
54	Standard		1., 1977	Cylindrical gears for general engineering and for heavy engineering - Modules and diametral pitches	1	60
677	Standard		1., 1976	Straight bevel gears for general engineering and heavy engineering - Basic rack	2	60
678	Standard		1., 1976	Straight bevel gears for general engineering and heavy engineering - Modules and diametral pitches	1	60
701	Standard		1., 1976	International gear notation - Symbols for geometrical data	5	60
1122-1	Standard	(R)	1., 1983	Glossary of gear terms - Part 1: Geometrical definitions	34	60
1122-2	Project		?	Glossary of gear terms - Part 2: Metric dimensions of speed reducing worm gears	-	60
1328	Standard	(R)	1., 1975	Parallel involute gears - ISO system of accuracy	35	60
1328-1	Project		?	Accuracy of cylindrical gears - Part 1: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth	-	60
1328-2	Project		?	Accuracy of cylindrical gears - Part 1: Definitions and allowable values relevant to radial composite allowance and backlash	-	60
1340	Standard		1., 1976	Cylindrical gears - Information to be given to the manufacturer by the purchaser in order to obtain the gear required	2	60
1341	Standard		1., 1976	Straight bevel gears - Information to be given to the manufacturer by the purchaser in order to obtain the gear required	2	60
2490	Standard	(R)	1., 1975	Single-start solid (monobloc) gear hobs with axial keyway, 1 to 20 module and 1 to 20 diametral pitch - Nominal dimensions	3	60

4467	Techn.Report	1., 1982	Addendum modification of the teeth of cylindrical gears for speed-reducing and speed-increasing gear pairs	12	60
4468	Standard	1., 1982	Gear hobs- Single start - Accuracy requirements	16	60
10063	Project	?	Cylindrical Gears - Flanks, undulation, surface roughness, shaft centre distance and parallelism of axis - Numerical values	-	60
10064-1	Standard	1., 1992	Cylindrical Gears - Guide to the inspection practice - Part 1: Inspection related to corresponding flanks of gear teeth	40	60
10064-2	Project	?	Cylindrical Gears - Guide to the inspection practice - Part 2: Inspection relevant to radial composite deviations, run out and tooth thickness allowance	-	60
10347	Project	?	Cutting of worm gears - Information to be given to the manufacturer by the purchaser in order to obtain the required gear	-	60

3 Splines

Number	Status	Edition year	Title	Pages	TC/SC
14	Standard	2., 1982	Straight-sided splines for cylindrical shafts with internal centering - Dimensions, tolerances and verification	12	14
4156	Standard	1., 1981	Straight cylindrical involute splines - Metric module, side fit - Generalities, dimensions and inspection	138	14
6413	Standard	1., 1988	Technical drawings - Representation of splines and serrations	5	10

ICS 17.040.10

Descriptors: workpieces, specifications, geometrical product specifications, dimensions, shape, geometric characteristics, mechanical tolerances, surface condition, surveys

Price based on 21 pages