INTERNATIONAL STANDARD

**ISO 22081**

First edition
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# Geometrical product specifications (GPS) — Geometrical tolerancing — General geometrical specifications and general size specifications

*Spécification géométrique des produits (GPS) — Tolérancement géométrique — Spécifications géométriques générales et spécifications de taille générales*



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# Foreword

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 290, *Dimensional and geometrical product specification and verification*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO 2768-2:1989, which has been technically revised.

The main changes to ISO 2768-2:1989 are as follows:

— tools have been added to specify a general geometrical specification and a general size specification;

— the rules for application of general geometrical specification and general size specification have been clarified.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.



# Introduction

This document is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain links A, B and C of the chain of standards on size, distance, form, orientation and location.

The ISO/GPS matrix model given in ISO 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to the specifications made in accordance with this document, unless otherwise indicated.

For more detailed information of the relation of this document to other standards and the GPS matrix model, see Annex C.

This document deals with general geometrical specification and general size specifications, which can be used to reduce the number of individual specification indications in technical product documentation (TPD). Many geometrical features have individual specifications which are similar or identical. As an alternative, general geometrical specifications, general size specifications or both may be applied.

All figures in this document for the 2D drawing indications have been drawn in first-angle projection with dimensions and tolerances in millimetres. It should be understood that third-angle projection and other units of measurement could have been used equally well without prejudice to the principles established.

The figures in this document represent either 2D drawing views or 3D axonometric views and are intended to illustrate how a specification can be fully indicated with visible annotation. For possibilities of illustrating a specification where elements of the specification may be available through a query function or other interrogation of information on the 3D CAD model, and rules for attaching specifications to 3D CAD models, see ISO 16792.

All figures are not complete and should not be seen as a way to fully specify a part. Theoretically exact dimensions (TED) which are not indicated are assumed to be obtained from the 3D CAD model.

# Geometrical product specifications (GPS) — Geometrical tolerancing — General geometrical specifications and general size specifications

## 1 Scope

This document gives rules for definition and interpretation of general geometrical specifications and general size specifications defined according to ISO 8015:2011, 5.12.

General specifications defined in other standards, and the link to these standards, are not covered by this document.

The general geometrical specifications and general size (linear or angular) specifications defined in this document apply only to integral features (including features of size).

These specifications do not apply to derived features or integral lines (see ISO 17450-1 for the definitions of integral features and derived features).

Dimensions other than linear or angular sizes (see ISO 14405-2) are not covered by this document.

## 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 8015, *Geometrical product specifications (GPS) — 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, uncertainties and ambiguities*

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

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

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8015, ISO 17450-1, ISO 17450-2, ISO 22432 and ISO 25378 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**
**general geometrical specification**
geometrical specification indicated in the technical product documentation (TPD) which is not an individual specification

**3.2**
**general size specification**
size specification (linear size specification or angular size specification) indicated in the technical product documentation (TPD) which is not an individual specification

Note 1 to entry: Linear size specifications are defined in ISO 14405-1. Angular size specifications are defined in ISO 14405-3.

**3.3**
**integral feature**
geometrical feature belonging to the real surface of the workpiece or to a surface model

Note 1 to entry: An integral feature is intrinsically defined, e.g. skin of the workpiece.

Note 2 to entry: For the statement of specifications, features obtained from partition of the surface model or of real surface of workpiece shall be defined. These features, called "integral features", are models of the different physical parts of the workpiece that have specific functions, especially those in contact with the adjacent workpieces.

Note 3 to entry: An integral feature can be identified, for example, by:

— a partition of the surface model;

— a partition of another integral feature;

— a collection of other integral features.

[SOURCE: ISO 17450-1:2011, 3.3.5]

# 4 Basic principles

## 4.1 General

When using general geometrical specifications or general size specifications, the designer should be aware of the following risks:

— overlooking important functional requirements;

— selecting unnecessarily tight tolerances regarding the functional requirement.

It is the responsibility of the designer to ensure that:

— functional requirements are properly defined;

— the geometrical features influencing the functions are properly specified;

— the entire part, i.e. all geometrical features, is completely and unambiguously specified.

General geometrical specification and general size specification are ways of minimising the number of indications in a TPD.

## 4.2 Basic rule

This document defines two types of general specifications:

— general geometrical specifications;

— general size specifications.

**Rule A**: only the specifications defined in Tables 1 and 2 shall be used to define general geometrical specifications, general size specifications or both on integral features.

### 4.3 Indication in a technical product documentation (TPD)

**Rule B**: to apply general geometrical specifications, general size specifications or both according to this document, it shall be clearly indicated in or near the title block or in the product definition data set according to the following rules:

— wording 'General tolerances' followed by a reference to this document (i.e. ISO 22081), followed by the indication of the general geometrical specifications, the indication of the general size specifications or both (see Figure 1).

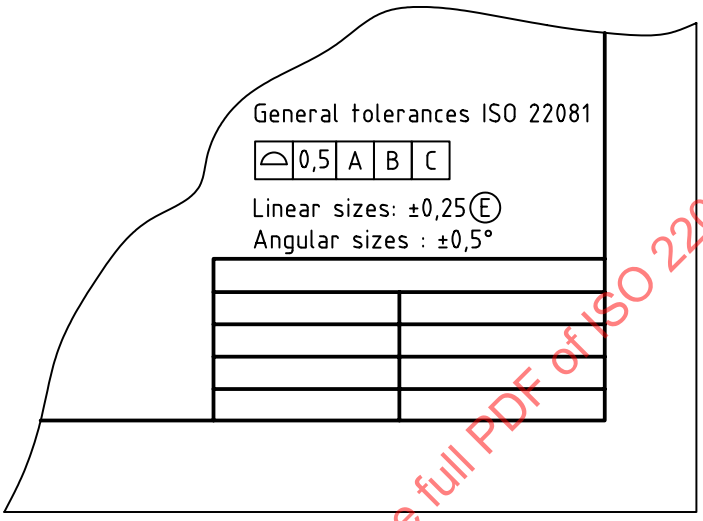



**Figure 1 — Indication of general geometrical specifications and general size specifications**

The tolerance values can be defined as:

— single values; or

— variable values.

Variable values may be dependent on either or both of:

— the dimensions of these integral features;

— the distance of the integral feature to the datum system (the TEDs).

When variable tolerance values are used, unambiguous rules should be defined to obtain these values from a table (see Annex A) or from other documents (see Figure 2).

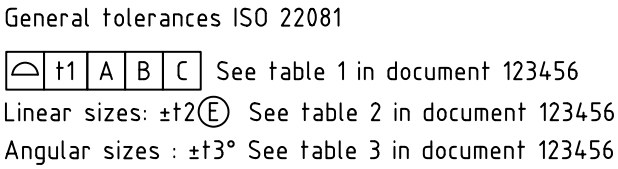


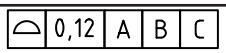

**Figure 2 — Example of indications with the tolerance values tabled in a referenced document**

## 5 General geometrical specification

### 5.1 Rule for indicating the general geometrical specification

**Rule C**: the general geometrical specification (see 3.1) shall be indicated with a surface profile specification (see Table 1 and Figure 3).

**Table 1 — General geometrical specification**

| Type | Example of specification indications in or near the title block |
|---|---|
| General geometrical specification |  |
| NOTE See 5.3 for datum systems. | |

Apart from the characteristic (which can only be surface profile), any specification element from ISO 5459 and ISO 1101 may be used in general geometrical specification as long as they do not contradict the rules given in this document.

## 5.2 Rule for the applicability of the general geometrical specification

**Rule D**: the general geometrical specification shall apply to each integral feature independently on the product, with the following exceptions (see Figure 3):

1) an integral feature specified by a size specification (individual size specification or general size specification);

2) an integral feature or its derived feature specified by an individual geometrical specification;

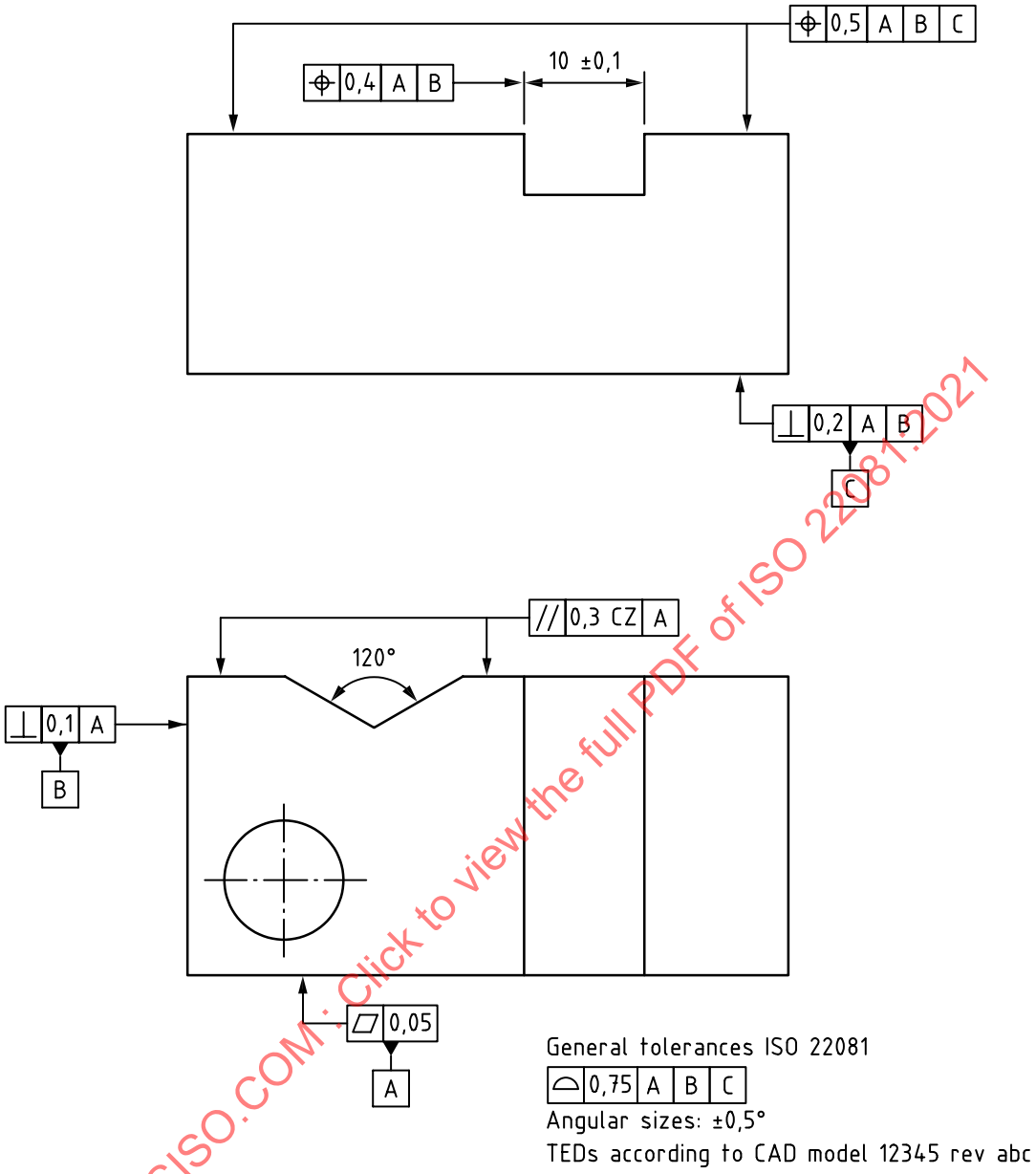
3) a datum feature used in the datum system defined in the datum section of the general geometrical specification (see 5.3);

4) an integral feature indicated with simplified representation and not included in the CAD model, for example edges, fillets or screw threads.

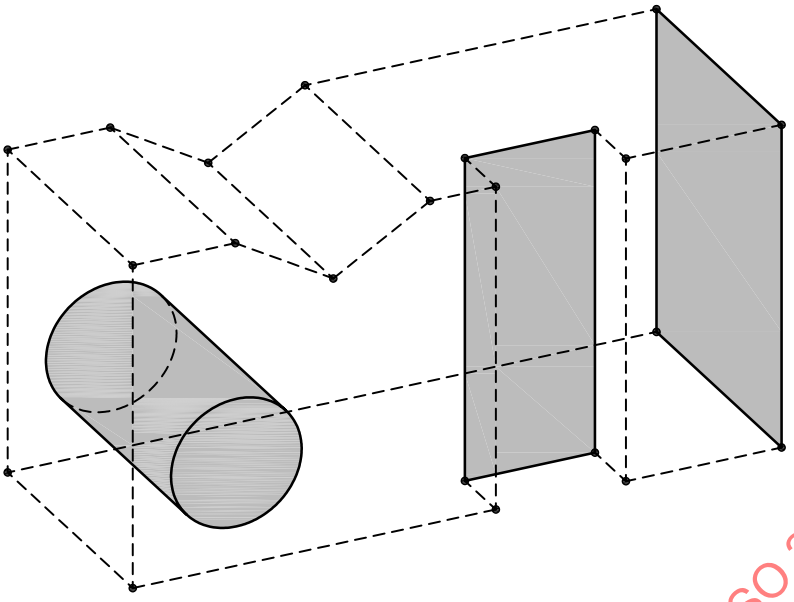
NOTE 1 General geometrical specification applies to integral features irrespective of a surface texture specification.

NOTE 2 The general geometrical specifications are in accordance with the independency principle and the feature principle.

NOTE 3 When individual specifications are applied on one or more portions of a single integral feature, any other portion is considered as another integral feature.




**a) Indication in the TPD**



**b) Integral features with general geometrical specification**

NOTE 1 The general geometrical specification applies to the integral features with shading in b), according to rule D.

NOTE 2 The general geometrical specification does not apply to:

— the two planes at 120° because they are specified by a general size specification (rule D1);

— the two parallel planes with 10 mm distance because they are specified by an individual size specification (rule D1);

— the two parallel planes with 10 mm distance because the derived feature is specified by an individual geometrical specification (rule D2);

— datum feature A because the integral feature is specified by an individual geometrical specification (rule D2);

— datum feature A because datum A is used in the datum section of the general geometrical specification (rule D3);

— datum feature B because the integral feature is specified by an individual geometrical specification (rule D2);

— datum feature B because datum B is used in the datum section of the general geometrical specification (rule D3);

— datum feature C because the integral feature is specified by an individual geometrical specification (rule D2);

— datum feature C because datum C is used in the datum section of the general geometrical specification (rule D3);

— the two planes opposed to datum feature C because the integral features are specified by an individual geometrical specification (rule D2);

— the two planes opposed to datum feature A because the integral features are specified by an individual geometrical specification (rule D2).

NOTE 3 See additional examples in Annex B.

**Figure 3 — Example of application of general geometrical specification**

## 5.3 Rules for the datum system

**Rule E**: in order to specify a general geometrical specification, a datum system shall be established.



**Rule F**: the datum system indicated in a general geometrical specification shall lock all degrees of freedom necessary to locate the tolerance zones defined by the general geometrical specification.

NOTE 1 This datum system does not necessarily consist of three datums and does not necessarily lock all six degrees of freedom.

Each of the datum features identified in the datum section of the general geometrical specification should have individual specifications, as they are not covered by the general geometrical specification.

NOTE 2 The general geometrical specification applies to any additional datum features according to the rules stated in this document.

# 6 General size specifications

## 6.1 Rule for indicating general size specifications

**Rule G**: the general size specifications (see 3.2) shall be indicated with a linear size, an angular size or both (see Table 2 and Figure 4).

**Table 2 — General size specifications**

| Type | Specification indications in or near the title block |
|---|---|
| General size specification | Linear sizes: $+t_5/-t_6$ or $\pm t_5$ or $JS_n/js_n$[a,b] |
| | Angular sizes : $+t_7°/-t_8°$ or $\pm t_7$[b] |
| [a] *n* represents the tolerance grade according to ISO 286-1 and ISO 286-2 (e.g. JS13/js13). | |
| [b] "JS/js" is only an example; any fundamental deviation defined in ISO 286 can be used. | |

Any specification element from ISO 14405-1 and ISO 14405-3 may be used in general size specifications as long as they do not contradict the rules given in this document.

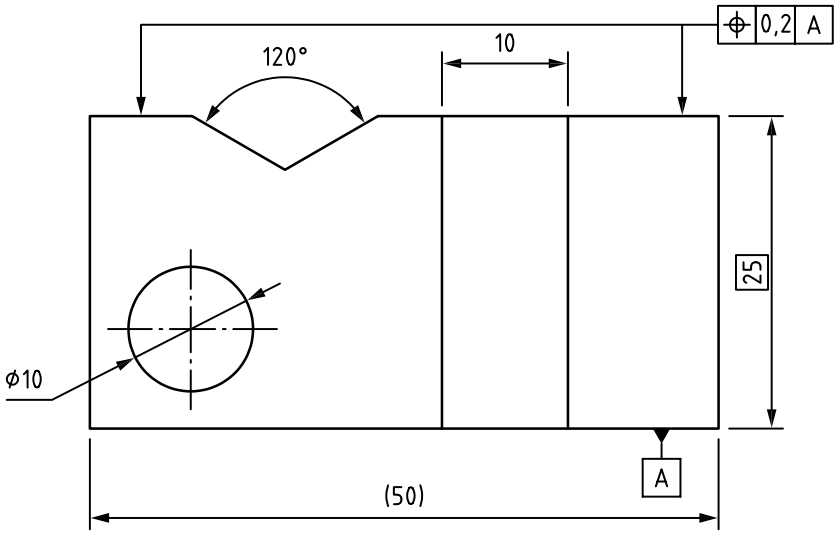
## 6.2 Rule for the applicability of general size specifications

**Rule H**: general size specifications shall apply to each feature of size which is identified in the TPD by one of the following methods:

1) By a size indication defining the nominal value of the linear or angular size (see Figure 4) which:
   - has no individual tolerance;
   - is not a TPD; and
   - is not an auxiliary dimension.
2) By a CAD attribute which defines the nominal value of the feature of size.

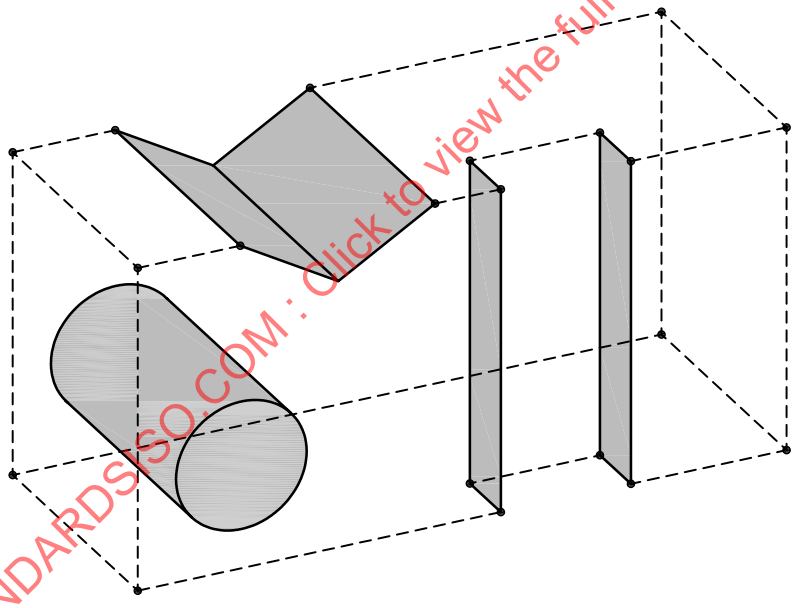
NOTE 1 General size specifications apply to features of size irrespective of a surface texture specification.

NOTE 2 General size specifications apply to features of size irrespective of a geometrical specification.




General tolerances ISO 22081
Linear sizes: ±0,25Ⓔ
Angular sizes: ±0,5°
TEDs according to CAD model 12345 rev abc

**a) Indication in the TPD**



**b) Features of size with general size specifications**

NOTE 1 General size specifications apply to the features of size with shading in b), according to rule H.

NOTE 2 According to rule H, the general size specifications do not apply to:

— the two parallel planes with the dimension 25 mm because 25 is a TED;

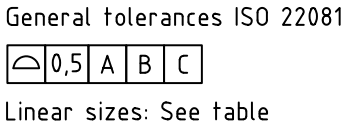
— the two parallel planes with the dimension 50 mm because 50 is an auxiliary dimension.

**Figure 4 — Example of application of general size specifications**

# Annex A
(informative)

# Example of indication with reference to a table in the TPD

Figure A.1 shows an example of general size specification where tolerance values are defined with a reference to a table in the TPD.




**a) Indication**

| Nominal linear sizes | ≤ to 6 | 6 < S ≤ 10 | 10 < S ≤ 25 | 25 < S ≤ 50 | 50 < S ≤ 100 | 100 < S ≤ 250 | 250 < S ≤ 500 |
|---|---|---|---|---|---|---|---|
| Tolerance values | ±0,1 | ±0,2 | ±0,3 | ±0,4 | ±0,5 | ±0,75 | ±1 |

**b) Table**

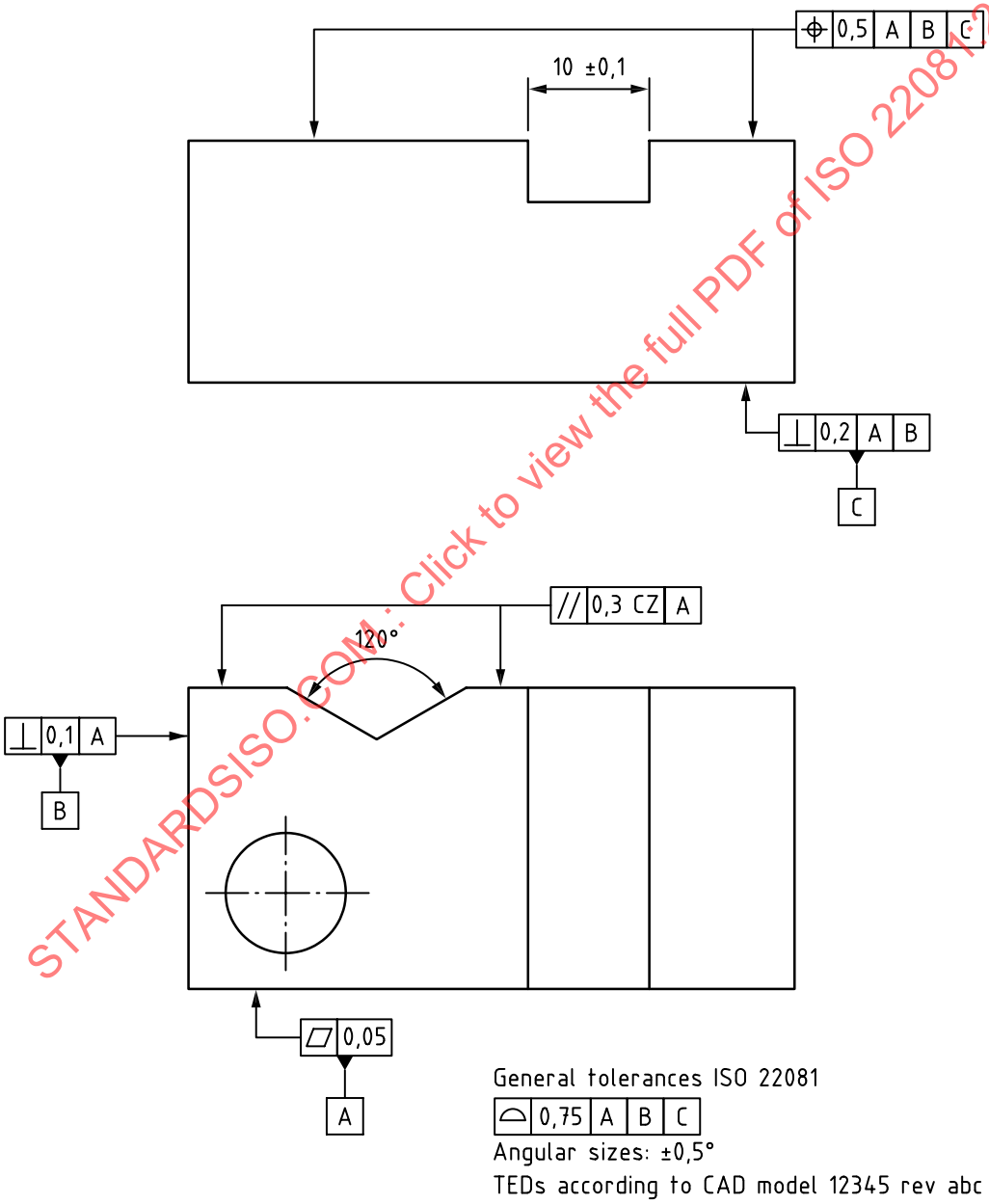
**Figure A.1 — Example of indication with reference to a table in the TPD**

# Annex B
(informative)

# Examples

## B.1 Example with integral features on which the location is not specified

Figure B.1 shows an example with integral features on which the location is not specified.






NOTE This specification is incomplete.

— The general geometrical specification does not apply to the two planes at 120°, because they are specified by a general size specification (rule D1). For this reason, the location of the two planes is not defined.

— The general geometrical specification does not apply to the two parallel planes with 10 mm distance because they are specified by an individual size specification (rule D1). For this reason, the location of the two planes is not defined.

— The general geometrical specification does not apply to the two planes opposed to datum feature A because the integral features are specified by an individual geometrical specification (Rule D2). The location of the two planes is not defined because only a parallelism tolerance is specified.

**Figure B.1 — Example with integral features on which the location is not specified**

## B.2 Example with two datums in the datum system of the general geometrical specification

Figure B.2 shows an example with two datums in the datum system of the general geometrical specification.

The datum system A-B|C locks all the necessary degrees of freedom, according to rule F.

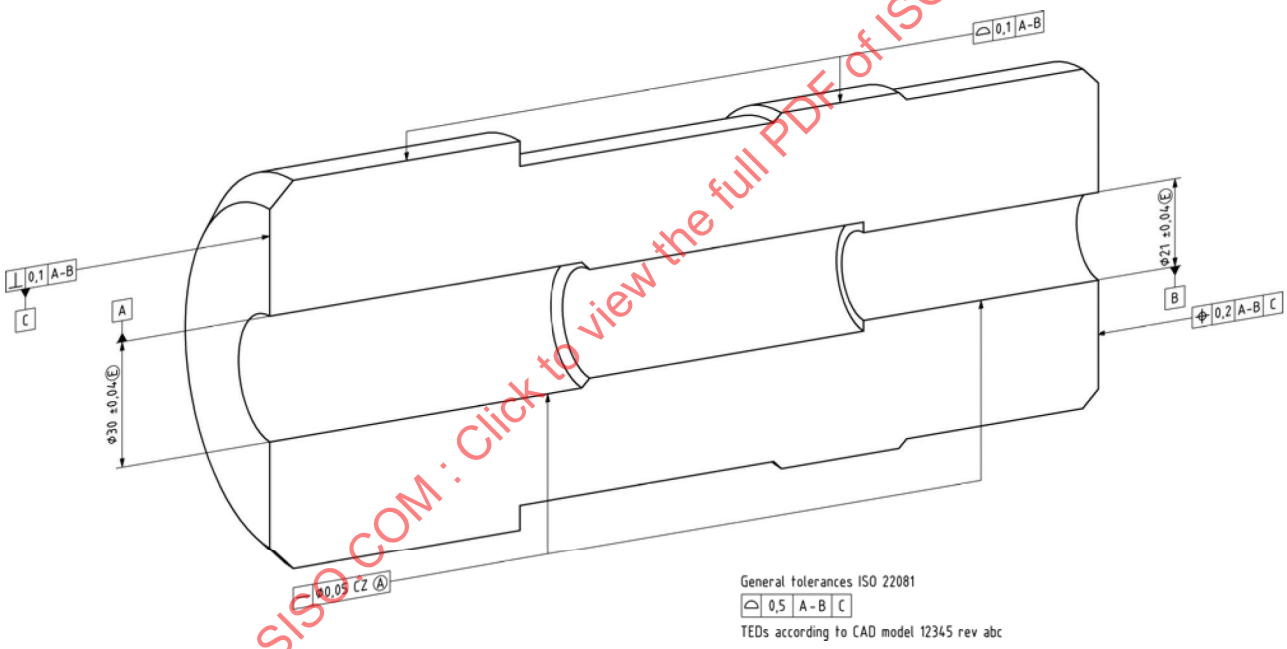



**Figure B.2 — Example with two datums in the datum system of the general geometrical specification**

## B.3 Example where the indication of the general size specification is missing

The specification in Figure B.3 is incomplete: the two dimensions 10 have no tolerance because the general size specification is not indicated in the TPD.