FINAL
DRAFT

AMENDMENT

ISO 1101:2004 FDAM 1

ISO/TC **213**

Secretariat: **DS**

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2011-03-13

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

AMENDMENT 1: Representation of specifications in the form of a 3D model

Spécification géométrique des produits (GPS) — Tolérancement géométrique — Tolérancement de forme, orientation, position et battement

AMENDEMENT 1: Représentation des spécifications sous forme d'un modèle 3D

Reference number
ISO 1101:2004/FDAM 1:2011(E)

Foreword

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

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

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.

Amendment 1 to ISO 1101:2004 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*. It cancels and replaces ISO 10578:1992. After approval, this amendment will be combined with the second edition of ISO 1101 (ISO 1101:2004) to form a third edition.

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

AMENDMENT 1: Representation of specifications in the form of a 3D model

Page v, Introduction

Replace the fifth paragraph with the following:

> All figures in this International Standard 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. For all figures giving tolerancing examples in 3D, the dimensions and tolerances are the same as for the similar figures shown in 2D.

At the end of the sixth paragraph, add the following:

> Neither are the figures intended to imply a particular display requirement in terms of whether hidden detail, tangent lines or other annotations are shown or not shown. Many figures have lines or details removed for clarity, or added or extended to assist with the illustration of the text.

Pages 1 and 2, Normative references

Add the following reference and its footnote:

> ISO 17450-1:—[11)], *Geometrical product specification (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

Delete the reference to ISO 10578:1992.

Replace the references to ISO 2692:— [1)], ISO 5459:1981, ISO 8015:1985, ISO 10579:1993, ISO/TS 12180-1:2003, ISO/TS 12180-2:2003, ISO/TS 12181-1:2003, ISO/TS 12181-2:2003, ISO/TS 12780-1:2003, ISO/TS 12780-2:2003, ISO/TS 12781-1:2003, ISO/TS 12781-2:2003, ISO/TS 17450-2:2002, with the following:

> ISO 2692:2006, *Geometrical product specifications (GPS) — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)*
>
> ISO 5459:—[1)], *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*
>
> ISO 8015:—[2)], *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*
>
> ISO 10579:2010, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*
>
> ISO 12180-1:—[3)], *Geometrical product specifications (GPS) — Cylindricity — Part 1: Vocabulary and parameters of cylindrical form*

ISO 12180-2:—[4], *Geometrical product specifications (GPS) — Cylindricity — Part 2: Specification operators*

ISO 12181-1:—[5], *Geometrical product specifications (GPS) — Roundness — Part 1: Vocabulary and parameters of roundness*

ISO 12181-2:—[6], *Geometrical product specifications (GPS) — Roundness — Part 2: Specification operators*

ISO 12780-1:—[7], *Geometrical product specifications (GPS) — Straightness — Part 1: Vocabulary and parameters of straightness*

ISO 12780-2:—[8], *Geometrical product specifications (GPS) — Straightness — Part 2: Specification operators*

ISO 12781-1:—[9], *Geometrical product specifications (GPS) — Flatness — Part 1: Vocabulary and parameters of flatness*

ISO 12781-2:—[10], *Geometrical product specifications (GPS) — Flatness — Part 2: Specification operators*

ISO 17450-2:—[12], *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*

Delete the existing reference to Footnote 1) and the footnote "To be published. (Revision of ISO 2692:1988)".

Add the following footnotes:

1) To be published. (Revision of ISO 5459:1981)

2) To be published. (Revision of ISO 8015:1985)

3) To be published. (Revision of ISO/TS 12180-1:2003)

4) To be published. (Revision of ISO/TS 12180-2:2003)

5) To be published. (Revision of ISO/TS 12181-1:2003)

6) To be published. (Revision of ISO/TS 12181-2:2003)

7) To be published. (Revision of ISO/TS 12780-1:2003)

8) To be published. (Revision of ISO/TS 12780-2:2003)

9) To be published. (Revision of ISO/TS 12781-1:2003)

10) To be published. (Revision of ISO/TS 12781-2:2003)

11) To be published. (Revision of ISO/TS 17450-1:2005)

12) To be published. (Revision of ISO/TS 17450-2:2002)

Page 2, Terms and definitions

Add the following terms and definitions:

3.2
intersection plane
plane, established from an extracted feature of the workpiece, identifying a line on an extracted surface (integral or median) or a point on an extracted line

NOTE The use of intersection planes makes it possible to define toleranced features independent of the view.

3.3
orientation feature
feature, established from an extracted feature of the workpiece, identifying the orientation of the tolerance zone

NOTE 1 For a derived feature, the use of an orientation feature makes it possible to define the direction of the width of the tolerance zone independent of the TED model (case of location) or of the datum (case of orientation).

NOTE 2 The orientation feature is only used when the toleranced feature is a median feature (centre point, median straight line) and the tolerance zone is defined by two parallel straight lines or two parallel planes.

3.4
direction feature
feature, established from an extracted feature of the workpiece, identifying the direction in which the tolerance value applies

NOTE 1 The direction feature can be a plane, a cylinder or a cone.

NOTE 2 For a line in a surface, the use of a direction feature makes it possible to change the direction of the width of the tolerance zone.

NOTE 3 The direction feature is used on a complex surface or a complex profile when the direction of the tolerance value is not normal to the specified geometry.

NOTE 4 By default, the direction feature is a cone, a cylinder or a plane constructed from the datum or datum system defined in the tolerance frame. The geometry of the direction feature depends on the geometry of the toleranced feature.

3.5
compound continuous feature
feature composed of several single features joined together without gaps

NOTE 1 A compound continuous feature can be closed or not.

NOTE 2 A non-closed compound continuous feature can be defined by the way of using the “between” symbol (see 10.1.4).

NOTE 3 A closed compound continuous feature can be defined by the way of using the “all around” symbol (see 10.1.2). In this case, it is a set of single features whose intersection with any plane parallel to a collection plane is a line or a point.

3.6
collection plane
plane, established from a nominal feature on the workpiece, defining a closed compound continuous feature

NOTE The collection plane may be required when the “all around” symbol is applied.

3.7
theoretically exact dimension
TED
dimension indicated on technical product documentation, which is not affected by an individual or general tolerance

NOTE 1 For the purpose of this International Standard, the term "theoretically exact dimension" has been abbreviated TED.

NOTE 2 A theoretically exact dimension is a dimensions used in operations (e.g. association, partition, collection, …).

NOTE 3 A theoretically exact dimension can be a linear dimension or an angular dimension.

NOTE 4 A TED can define

— the extension or the relative location of a portion of one feature,

— the length of the projection of a feature,

— the theoretical orientation or location from one or more features, or

— the nominal shape of a feature.

NOTE 5 A TED is indicated by a rectangular frame including a value.

Page 3, 4.1

In the Note, delete "on a drawing".

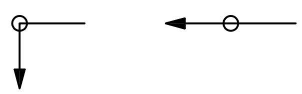
Page 5, Table 2

Before the line "Projected tolerance zone", add the following:

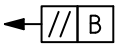
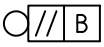
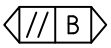
Median feature	Ⓐ	Clause 7
Unequally disposed tolerance	(UZ)	Subclause 10.2
Between	←→	Subclause 10.1.4
From … to	→	Subclause 10.1.4

In the third column, delete the reference to "and ISO 10578" on the line "Projected tolerance zone".

In the second column, replace the symbol corresponding to "All-around profile" with the following:



At the end of the table, add the following additional lines:

Direction feature		Subclause 8.2
Collection plane		Subclause 10.1.2
Intersection plane		Clause 19
Orientation plane		Clause 20

Page 6, 6.1

Replace the list items with the following:

— first compartment: the symbol for the geometrical characteristic;

— second compartment: the width of the tolerance zone in the unit used for linear dimensions and complementary requirements (see Clauses 7, 8, 10, and 12 to 16). If the tolerance zone is circular or cylindrical, the value is preceded by the symbol "∅". If the tolerance zone is spherical, the value is preceded by "S∅";

— third and subsequent compartment, if applicable: the letter or letters identifying the datum or common datum or datum system (see examples in Figures 2, 3, 4 and 5).

Page 6

Add the following Subclause 6.5:

6.5 If required, indications qualifying the direction of the tolerance zone or the extracted (actual) line or both shall be written after the tolerance frame, e.g. use of intersection plane to indicate the direction of the toleranced feature (see Clause 7), use of the orientation plane to indicate the orientation of the tolerance zone, use of the direction feature to indicate the direction of the width of the tolerance zone (see Clause 8).

Page 7, Clause 7

Replace the first paragraph and first list item with the following:

A geometrical specification tolerance applies to a single complete feature, unless an appropriate modifier is indicated. When the toleranced feature is not a single complete feature, see Clause 10.

When the tolerance **refers to the feature itself** (integral feature), the tolerance frame shall be connected to the toleranced feature by a leader line starting from either side of the frame and terminating in one of the following ways:

— In *2D annotation*, on the outline of the feature or an extension of the outline (but clearly separated from the dimension line) (see Figures 10 and 11). The termination of the leader line is

— an arrow if it terminates on a drawn line, or

— a dot (filled or unfilled) if it does not terminate on a drawn line.

The arrowhead may be placed on a reference line using a leader line to point to the surface (see Figure 12).

— In *3D annotation*, on the feature itself or on an extension line in continuation of the feature (but clearly separated from the dimension line) [see Figures 10 (3D) and 11 (3D)]. The termination of the leader line is a dot. When the surface is visible, the dot is filled out; when the surface is hidden the dot is not filled out.

  The termination of the leader line may be an arrow placed on a reference line using a leader line to point to the surface [see Figure 12 (3D)]. The above rules for the dot terminating the leader line also apply in this case.

Add the following figures after Figure 12:

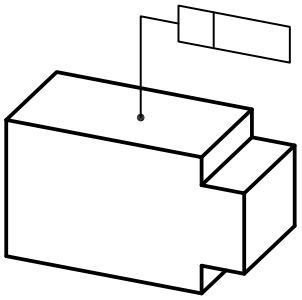


Figure 10 (3D)

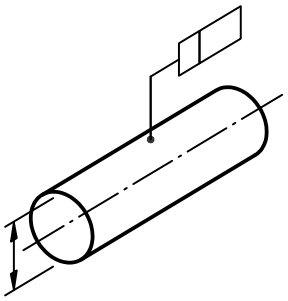


Figure 11 (3D)

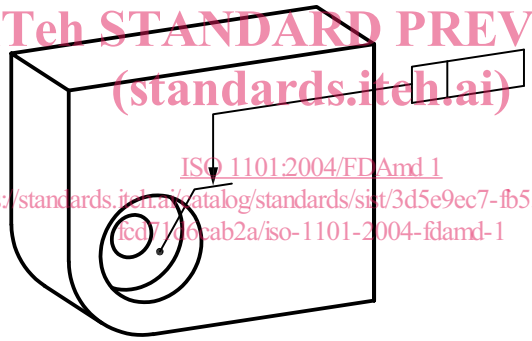


Figure 12 (3D)

Replace the second list item with the following:

When the tolerance refers to a median line, a median surface, or a median point (derived feature), it is indicated either

— by the leader line starting from the tolerance frame terminated by an arrow on the extension of the dimension line of a feature of size [see examples of Figures 13, 14, 14 (3D), 15 and 15 (3D)], or

— by a modifier Ⓐ (median feature) placed at the rightmost end of the second compartment of the tolerance frame (from the left). In this case the leader line starting from the tolerance frame does not have to terminate on the dimension line, but can terminate with an arrow on the outline of the feature or an extension of the outline [see Figures 15X (2D) and 15X (3D)].

After Figures 13 to 15, add the following figures:

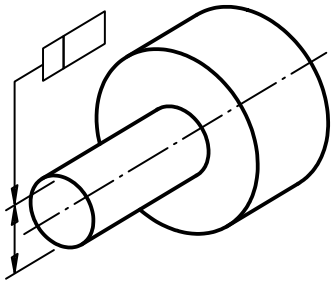


Figure 14 (3D)

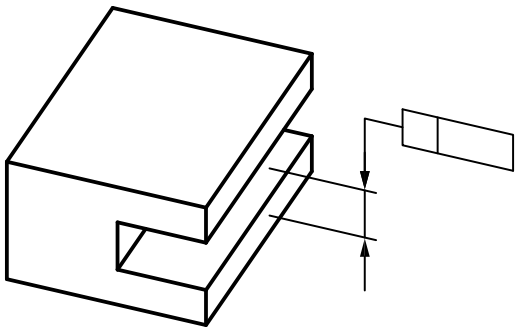


Figure 15 (3D)

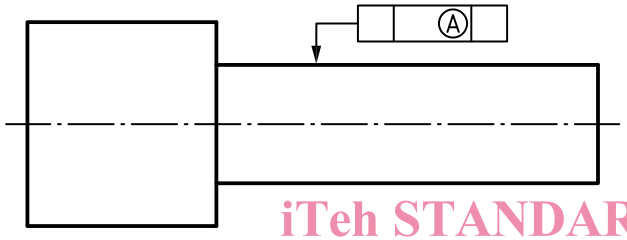


Figure 15X (2D)

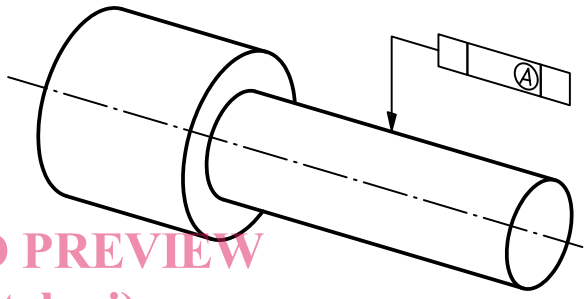


Figure 15X (3D)

Replace the note with the following:

NOTE When the toleranced feature is a line, a further indication may be needed to control the orientation of the toleranced feature, see Figure 83 for the case of a median line and Figure 89 for the case of an integral line.

Pages 8 to 10, Figures 16, 18, 21 and 23

Replace “drawning indication” with “drawing indication”.

Page 8, 8.1

Replace the first paragraph with the following:

The tolerance zone is positioned symmetrically from an ideal feature unless otherwise indicated (see 10.2). The tolerance value defines the width of the tolerance zone. This width applies normal to the specified geometry (see Figures 16 and 17) unless otherwise indicated (see Figures 18 and 19).

Page 8

At the end of 8.1, add the following:

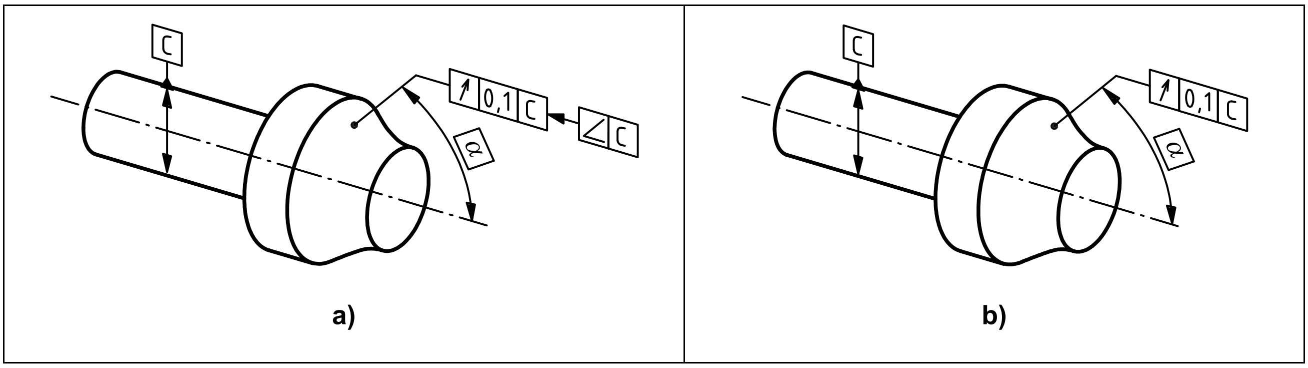


Figure 18 (3D)

NOTE 1 When the datum feature identified by the tolerance frame is the same as the feature establishing the direction feature, then the direction feature can be omitted.

NOTE 2 In Figure 18, the theoretical shape of each toleranced feature is a circle. The straight segments are inclined by the angle alpha. This generates a set of tolerance zones which are conical sections with a fixed angle along the surface.

When a direction feature is indicated as shown in Figure 18, the width of the tolerance zone is defined by an infinite set of straight segments, each of which has a length equal to the tolerance value and has its midpoint located on the theoretical shape of the tolerance zone. If the “UZ” modifier (unequally disposed tolerance) is applied, then the segments defining the width of the tolerance zone have their midpoints offset in the direction indicated, and by the value given with the “UZ” modifier.

The tolerance value is constant along the length of the considered feature, unless otherwise indicated by a graphical indication, defining a proportional variation from one value to another, between two specified locations on the considered feature, identified as given in 10.1.4. The letters identifying the locations are separated by an arrow (see Figure 19X for restricted parts of a feature). The values are related to the specified locations on the considered feature by the letters indicated over the tolerance frame (e.g. in Figure 19X, the value of the tolerance is 0,1 for location J and 0,2 for location K). By default, the proportional variation follows the curvilinear distance, i.e. the distance along the curve connecting the two specified locations.

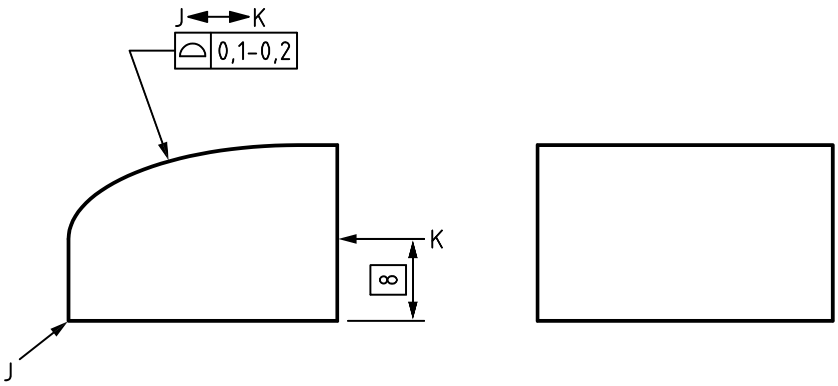


Figure 19X

Page 9, 8.2

Replace the first line with the following:

In the case of a median feature (centre point, median line, median surface) toleranced in one direction:

Replace the first list item with the following:

— In 2D view, when the direction of the width of a tolerance zone is at 0° or 90° relative to the datum or relative to the pattern of the theoretically exact dimensions without using an orientation plane, the arrow of the leader line gives this direction (Figures 20, 21 and 22). In other cases, an orientation plane shall be used.

Replace the second list item with the following:

— In 3D view, when the direction of the width of a tolerance zone is to be specified relative to the datum or relative to the pattern of the theoretically exact dimensions, an orientation plane shall be indicated to determine this direction (see Figure 21).

Page 9

After Figure 21, add the following figure:

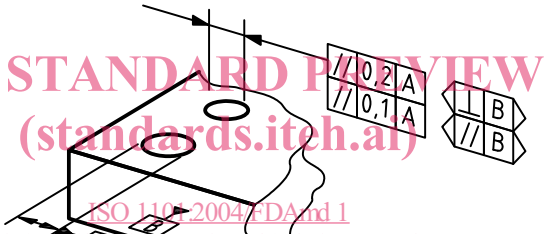


Figure 21 (3D)

Page 11

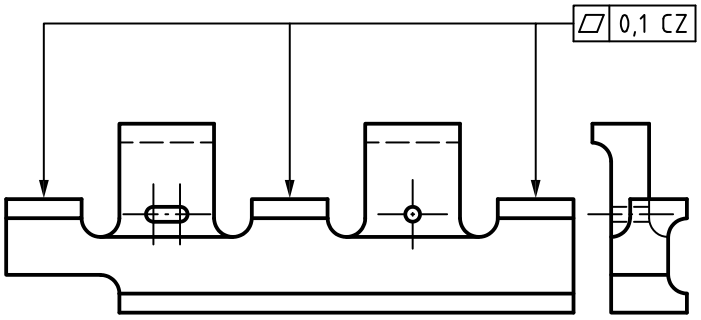
Replace 8.5 with the following:

8.5 Where a common tolerance zone is applied to several separate features, this common requirement shall be indicated by the symbol “CZ” for common zone following the tolerance in the tolerance frame [see examples of Figure 26 a)].

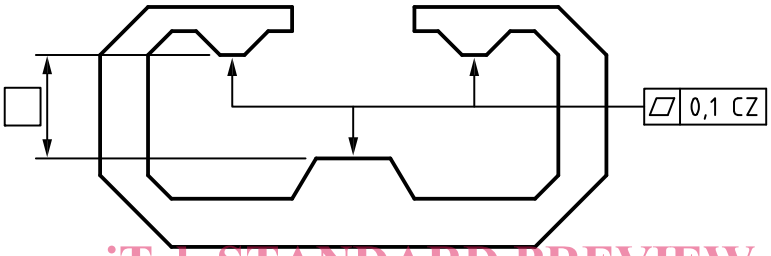
Where several tolerance zones (controlled by the same tolerance frame) are applied simultaneously to several separate features (not independently), to create a combined zone, the requirement shall be indicated by the symbol “CZ” for common zone following the tolerance in the tolerance frame [see example of Figure 26 b)] and an indication that the specification applies to several features [e.g. using “4 ×” over the tolerance frame (see 6.2), or using four leader lines attached to the tolerance frame (see 8.4)].

Where CZ is indicated in the tolerance frame, all the related individual tolerance zones shall be located and oriented amongst themselves using either implicit (0 mm, 0°, 90°, etc.) or explicit theoretically exact dimensions (TED).

Replace Figure 26 with the following:



a)



b)

Figure 26

Page 11, 9.2

Replace “(see examples of Figures 27 and 28)” by “[see examples of Figures 27 (2D), 27 (3D), Figures 28 (2D) and 28 (3D)]”.

Page 11

After Figures 27 and 28, add the following figures:

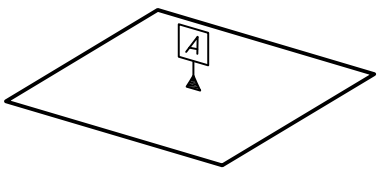


Figure 27 (3D)

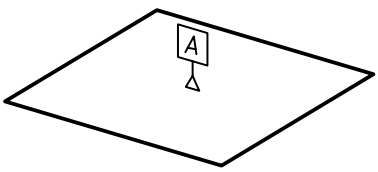


Figure 28 (3D)

Page 12, 9.3

In the first list item, add “In 2D annotation,...” at the beginning of the sentence.

Page 12

After Figures 29 and 30, add the following figures:

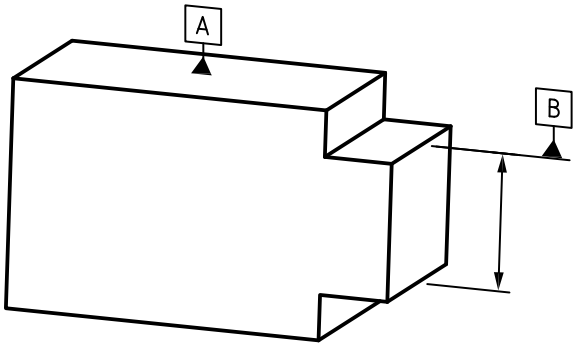


Figure 29 (3D)

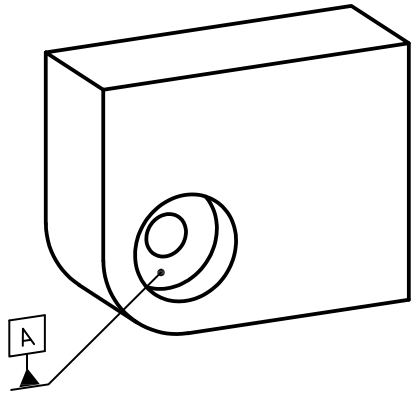


Figure 30 (3D)

Page 12, 9.3

Replace the second list item with the following:

— in 3D annotation, on the feature itself or on an extension line in continuation of the feature (but clearly separated from the dimension line), when the datum is the line or surface shown [see Figure 29 (3D)], the datum triangle may be placed on a reference line using a leader line to point to the surface [see Figure 30 (3D)];

— as an extension of the dimension line, when the datum is the axis or median plane or a point defined by the feature so dimensioned [see examples of Figures 31 to 33 for 2D annotation and Figures 31 (3D) to 33 (3D) for 3D annotation], if there is insufficient space for two arrowheads, one of them may be replaced by the datum triangle [see examples of Figures 32 and 33 for 2D annotation and Figures 32 (3D) and 33 (3D) for 3D annotation].