INTERNATIONAL STANDARD

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Third edition
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Geometrical product specifications (GPS) — Dimensioning and tolerancing — Cones

Spécification géométrique des produits (GPS) — Cotation et tolérancement — Cônes

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

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Foreword

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

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

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

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

ISO 3040 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This third edition cancels and replaces the second edition (ISO 3040:1990), which has been technically revised.

Introduction

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences chain links 1 and 2 of the chain of standards on angles.

For more detailed information on the relation of this International Standard to other standards and to the GPS matrix model, see Annex B.

In this International Standard, the figures illustrate the text only and should not be considered as design examples. For this reason, the figures are simplified and are not to scale.

Geometrical product specifications (GPS) — Dimensioning and tolerancing — Cones

1 Scope

This International Standard establishes the definition of cones and specifies the graphical symbol to be used for their indication and methods for their dimensioning and tolerancing.

For the purposes of this International Standard, the term “cone” relates to right-angle circular cones only.

NOTE 1 For simplicity, only truncated cones have been represented in this International Standard. However, this International Standard can be applied to any type of cone within its scope.

NOTE 2 This International Standard is not intended to prevent the use of other methods of dimensioning and tolerancing.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
rate of taper
C
ratio of the difference in the diameters of two sections of a cone to the distance between them

NOTE It is expressed by the following formula (see also Figure 1):

$$C = \frac{D-d}{L} = 2\tan\left(\frac{\alpha}{2}\right)$$

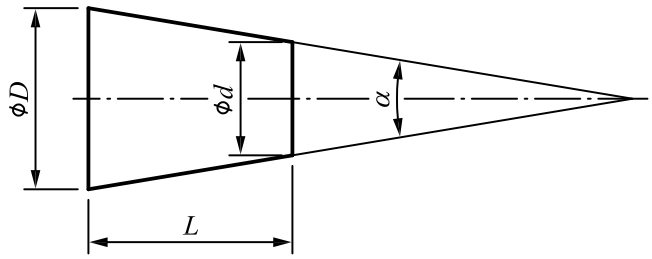


Figure 1

4 Graphical symbol for a cone

A cone shall be indicated using the graphical symbol illustrated in Figure 2 positioned on a reference line (see Figure 7). The orientation of the graphical symbol shall coincide with that of the cone (see Figure 7 and Figure 8).

For the size and line thickness of the graphical symbol, see ISO 81714-1.

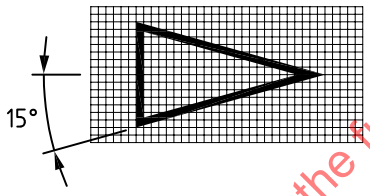


Figure 2

5 Dimensioning of cones

5.1 Characteristics of cones

In order to define a cone, the characteristics and dimensions shown in Table 1 may be used in those combinations most appropriate for the function of the cone.

Table 1 — Characteristics and dimensions of cones

Characteristics and dimensions	Letter symbol	Examples of indication	
		Preferred method	Optional method
Characteristics			
Rate of taper	C	1:5 1/5	0,2:1 20 %
Cone angle	α	35°	0,6 rad
Cone diameter			
at the larger end	D		
at the smaller end	d		
at the selected cross-section	D_x		
Length			
Cone length	L		
Length including cone length	L'		
Length locating a cross-section at which D_x is specified	L_x		

No more dimensions than are necessary shall be specified. However, additional dimensions (for example, half the included angle) may be given as “auxiliary” or “reference” dimensions in brackets for information.

Typical combinations of cone characteristics and dimensions are shown in Figure 3, Figure 4, Figure 5 and Figure 6.

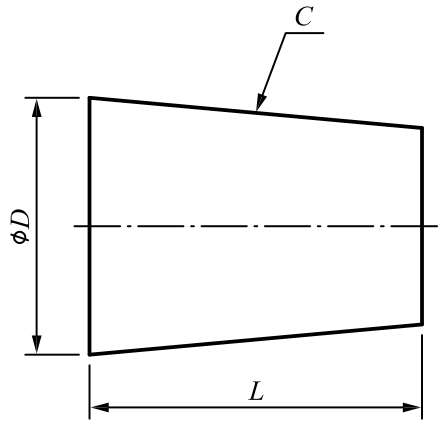


Figure 3

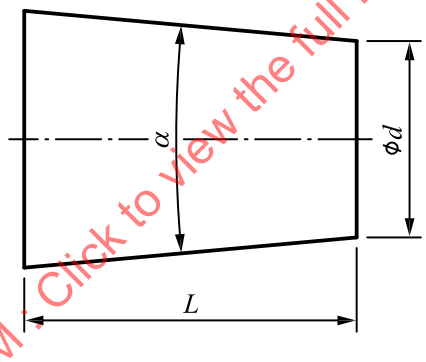


Figure 4

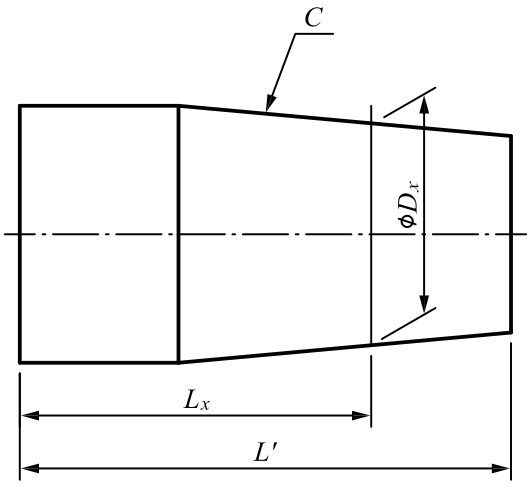


Figure 5

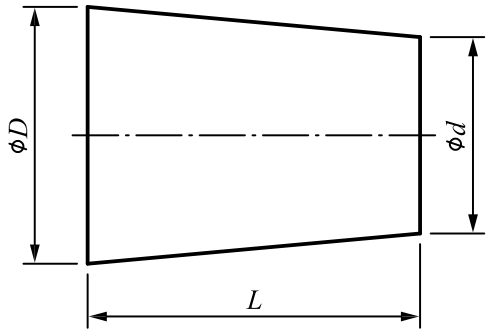
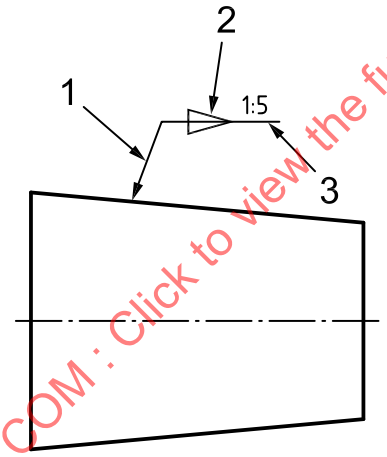


Figure 6

5.2 Indication of rate of taper on drawings

The graphical symbol and the rate of taper of a cone shall be indicated near the feature, and the reference line shall be connected to the outline of the cone by a leader line as shown in Figure 7. The reference line shall be drawn parallel to the centreline of the cone, and the orientation of the graphical symbol shall coincide with that of the cone.



Key

1 leader line
2 graphical symbol
3 reference line

Figure 7

5.3 Standardized series of cones

When the taper to be indicated is one of a standardized series of conical taper (in particular Morse or metric taper), the tapered feature may be designated by specifying the standard series (see ISO 1119) and appropriate number (see Figure 8).

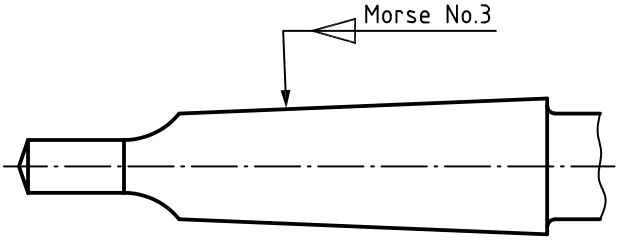


Figure 8

6 Tolerancing of cones

6.1 General

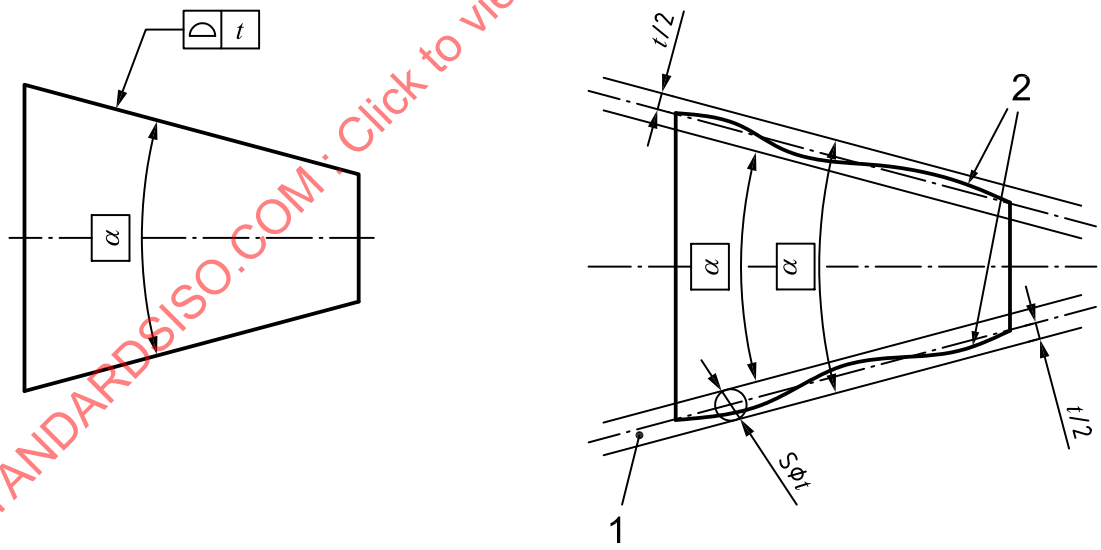
Cones shall be toleranced (both size and conical surface) in accordance with the methods given in 6.2 to 6.5.

The letter symbol t is used to define the width of the tolerance zone.

NOTE Other methods of tolerancing using only dimensional tolerances do not give adequate indication with regard to the form of the surface.

6.2 Tolerancing of cone, cone angle specified

See Figure 9.



a) Specification of the form of the cone **b) Interpretation**

Key

1 tolerance zone

2 extracted surface

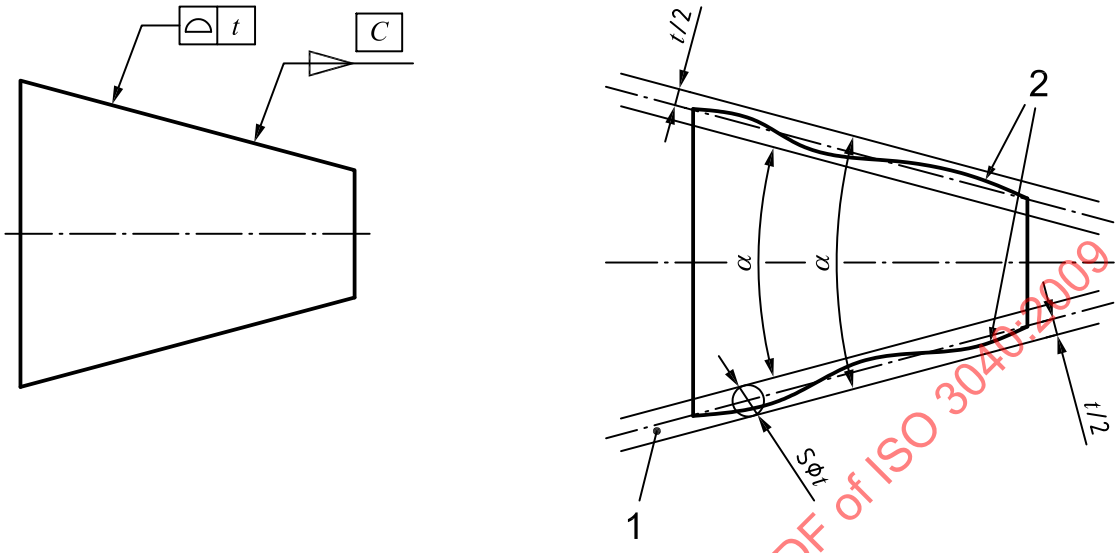
The tolerance zone is limited by two cones, each having a cone angle α, and located a distance t apart.

The extracted surface of the cone is required to be within this zone.

Figure 9

6.3 Tolerancing of cone; rate of taper specified

See Figure 10.



a) Specification of the form of the cone

b) Interpretation

Key

1 tolerance zone

2 extracted surface

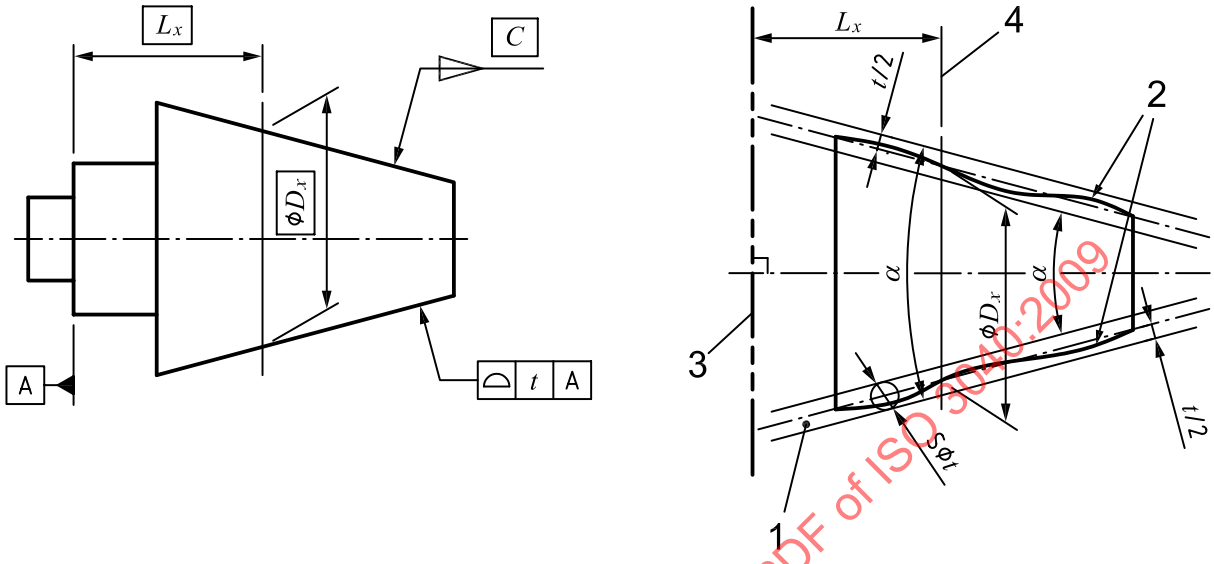
The tolerance zone is limited by two cones, each having a cone angle α, and located a distance t apart.

The cone angle of the zone corresponds to the rate of taper C. The extracted surface of the cone is required to be within this zone.

Figure 10

6.4 Tolerancing zone of cone simultaneously defining the axial location of the cone

See Figure 11.



a) Specification of the form and location of the cone

b) Interpretation

Key

1 tolerance zone
2 extracted surface
3 plane associated with the extracted "planar" surface, corresponding to the datum A
4 constructed plane at the distance L_x, in millimetres, from the associated plane

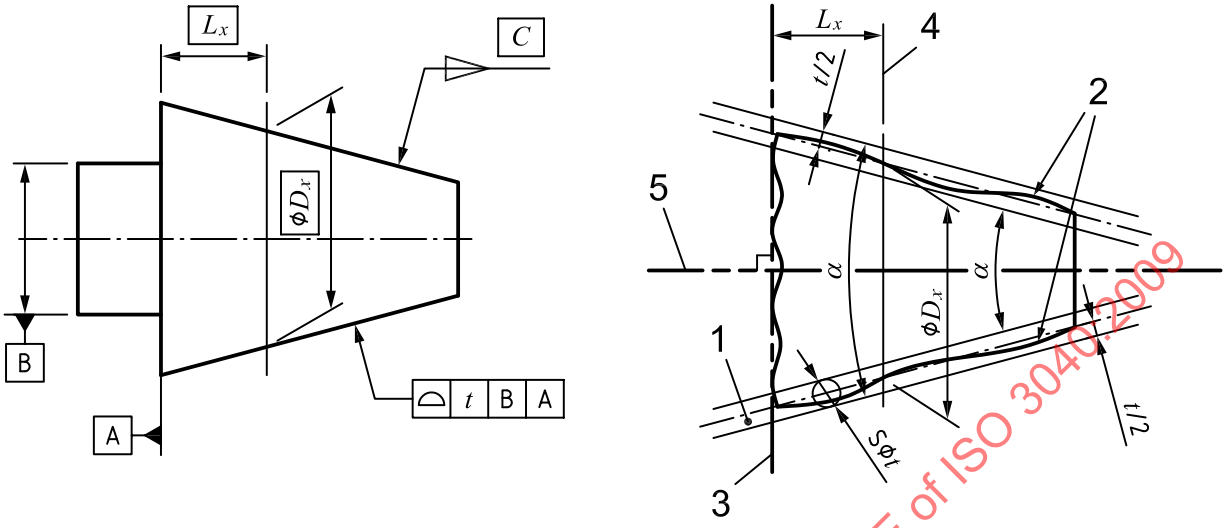
The tolerance zone is limited by two cones, each having a cone angle α, located a distance t apart.

The cone angle of the zone corresponds to the rate of taper C and to diameter D_x, measured at a distance L_x from datum A (associated plane). The extracted surface of the cone is required to be within this zone.

Figure 11

6.5 Tolerancing of cone relative to a datum system (simultaneously defining coaxiality)

See Figure 12.



a) Specification of the form and location of the cone

b) Interpretation

Key

1 tolerance zone
2 extracted surface
3 plane associated with the extracted “planar” surface, corresponding to the datum A
4 constructed plane at the distance L_x, in millimetres, from the associated plane
5 axis of the associated cylinder

The tolerance zone is limited by two cones, each having a cone angle α, located a distance t apart.

The cone angle of the zone corresponds to rate of taper C and the diameter D_x value, measured at a distance L_x from the datum A (associated plane); the axis of the tolerance zone is coaxial to the axis of the associated cylinder. The extracted surface of the cone is required to be within this zone.

Figure 12