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Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts —

Part 3: General dimensional and geometrical tolerances and machining allowances for castings using $\pm$ tolerances for indicated dimensions

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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.

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).

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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 190, *Dimensional and geometrical product specification and verification*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 8062-3:2007), which has been technically revised. It also incorporates the Technical Corrigendum ISO 8062-3:2007/Cor 1:2009.

The main changes are as follows:

- clarified in title and scope that this document specifies general dimensional and geometrical tolerances as well as machining allowance grades for castings using $\pm$ tolerances for indicated dimensions;
- definitions for the terms “draft angle”, “external draft value” and “internal draft angle” have been added;
- [Clause 4](#) and [Clause 5](#), including [Tables 2](#) to [6](#), have been added and subsequent clauses and tables have been renumbered;
- in [Table 7](#) the linear dimensional casting tolerance grade DCTG 16 has been changed to DCTG 15wt to clarify the concept of wall thickness;
- the nominal dimension to be used in the tables indicating casting tolerances for straightness, flatness, roundness, parallelism, perpendicularity, symmetry and coaxiality ([Tables 8](#) to [11](#)) has been changed;
- [Clause 12](#) on rejection has been clarified;
- the correction according to ISO 8062-3:2007/Cor 1:2009 has been added in [Table A.3](#), footnote b;
- the examples given in [Annex E](#) have been corrected;

— inconsistencies have been clarified.

A list of all parts in the ISO 8062 series can be found on the ISO website.

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.

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Introduction

This document is a geometrical product specification (GPS) standard and is regarded as a complementary process-specific tolerance standard (see ISO 14638). It influences chain links A and B on size and A, B and C on distance in the ISO GPS standards matrix model (see [Annex F](#)) but is not in full accordance with the ISO GPS rules.

For more detailed information on the relation of this document to other standards and the GPS matrix model, see [Annex F](#).

This document defines a system of tolerance grades and machining allowance grades for cast metals and their alloys. Guidance on its application is given in ISO/TS 8062-2.

It is noted that the dimensional specifications introduced by the application of this document can be ambiguous when applied to a dimension which is not a size (see ISO 14405-2).

The tolerances specified for a casting may determine the casting method. It is therefore recommended, before the design or the order is finalized, that the customer liaises with the foundry to discuss:

- a) the proposed casting design and accuracy required;
 - b) machining requirements;
 - c) moulding method, for example with or without core;
 - d) location of the parting surfaces and the necessary draft angles;
 - e) the number of castings to be manufactured;
 - f) the casting equipment involved;
 - g) the consequences of the equipment wearing out during its life cycle;
 - h) datum system according to ISO 5459;
 - i) casting alloy;
 - j) any special requirements, for instance individual dimensional and geometrical tolerances, fillet radii, tolerances and individual machining allowances;
- NOTE Tolerance grades which can be achieved for various methods and metals are described in [Annex A](#), because dimensional and geometrical accuracy of a casting is related to production factors.
- k) dimensional tolerances for long series and mass production, where development, adjustment and maintenance of casting equipment make it possible to achieve close tolerances;
 - l) dimensional tolerances for short series and single production;
 - m) geometrical tolerances.

Information on typical required machining allowance grades is given in [Annex B](#).

Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts —

Part 3:

General dimensional and geometrical tolerances and machining allowances for castings using $\pm$ tolerances for indicated dimensions

1 Scope

This document specifies general dimensional and geometrical tolerances as well as machining allowance grades for castings using $\pm$ tolerances for indicated dimensions as delivered to the purchaser according to ISO/TS 8062-2. It is applicable for tolerancing of dimensions and geometry of castings in all cast metals and their alloys produced by various casting manufacturing processes.

This document does not apply to 3D CAD models used without indicated dimensions.

This document applies to both general dimensional and general geometrical tolerances (referred to in or near the title block of the drawing), unless otherwise specified and where specifically referred to on the drawing by one of the references in [Clause 11](#).

The dimensional tolerances covered by this document are tolerances for linear dimensions.

The geometrical tolerances covered by this document are tolerances for:

- straightness;
- flatness;
- roundness;
- parallelism;
- perpendicularity;
- symmetry;
- coaxiality.

This document does not cover other position tolerances, angular dimensional tolerances or cylindricity tolerances.

This document can be used for the selection of tolerance values for individual indications.

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

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

ISO 1302:2002,¹⁾ *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 5459, *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*

ISO 8062-1, *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 1: Vocabulary*

ISO 10135, *Geometrical product specifications (GPS) — Drawing indications for moulded parts in technical product documentation (TPD)*

ISO 10579, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1101, ISO 5459, ISO 8062-1 and ISO 10135 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 draft angle taper

value of inclination (angle) that is added to a geometrical feature of a pattern or mould to ensure the removal of the pattern or moulded part from the mould

3.2 external draft value

draft angle (3.1) on a surface that has no opposite surface in the direction outward of the part

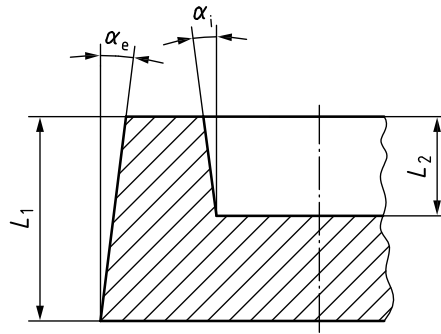
Note 1 to entry: See [Figure 1](#).

3.3 internal draft angle

draft angle (3.1) on a surface that has an opposite surface in the direction outward of the part

Note 1 to entry: See [Figure 1](#).

1) Cancelled and replaced by ISO 21920-1.

**Key**

- L_1 length of the external feature
 L_2 length of the internal feature
 α_e external draft angle
 α_i internal draft angle

Figure 1 — External and internal draft angles**4 Abbreviated terms**

For the purposes of this document, the abbreviated terms given in [Table 1](#) apply.

Table 1 — Abbreviated terms

Abbreviation	Full term
DCT	dimensional casting tolerance
DCTG	dimensional casting tolerance grade
GCT	geometrical casting tolerance
GCTG	geometrical casting tolerance grade
RMA	required machining allowance
RMAG	required machining allowance grade
TP	taper plus
TM	taper minus
SG	spheroidal graphite
SMI	surface mismatch

5 Taper

The parting surface shall be indicated by the symbols  and  according to ISO 10135.

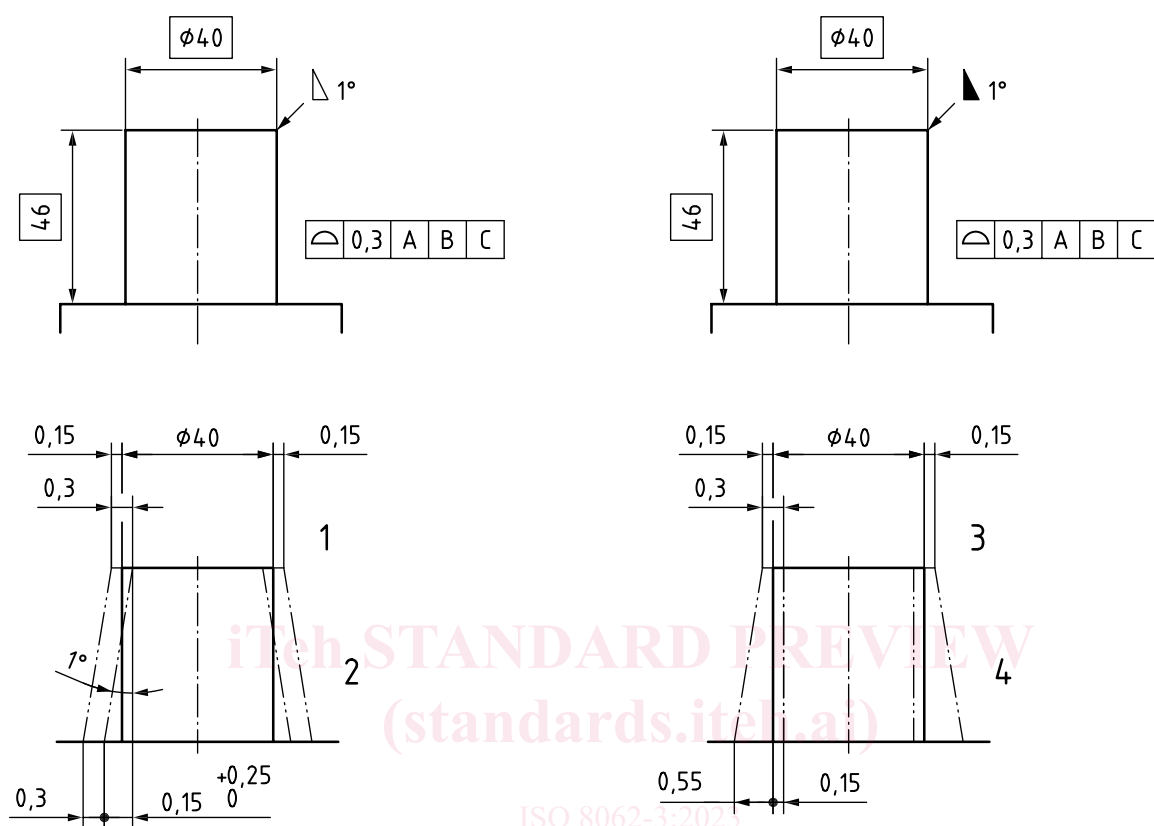
There are three possibilities to indicate taper:

- the taper is already included in the nominal model;
- the taper is indicated by the symbol .
- the taper is indicated by the symbol .

In case a) the general profile surface tolerance zone is located symmetrically to the nominal surface.

In case b) the general profile surface tolerance zone is located symmetrically to the surface when the taper is added to the nominal model.

In case c) the general profile surface tolerance zone increases steadily as shown in [Figure 2](#).



a) Draft angle increasing the ideal model feature(s)

b) Draft angle increasing the tolerance of feature(s)

Key

- 1 tolerance constant 0,3
- 2 ideal shape gradually increased $\phi 40 \rightarrow \phi 40,8$
- 3 tolerance gradually increased $0,3 \rightarrow 0,7$
- 4 ideal shape constant $\phi 40$

Figure 2 — Taper, tolerance zones

Unless otherwise indicated, taper plus (TP) shall apply. The exception to this rule is for features with the maximum material requirement specified, where taper minus (TM) shall apply.

6 Draft angles (taper)

If indicated in the general drawing indication, see [Clause 8](#), and if not otherwise individually indicated, the draft angles (taper) in accordance with [Tables 2](#) to [6](#) apply.

They apply to the longer feature in the direction of taper. For the shorter feature, if any, taper to fit applies, see ISO 10135. The taper applies as continuously increasing the tolerance (not increasing the nominal shape).

Table 2 — Draft angles for hand moulding casting

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External	Internal	External	Internal
> 0	≤ 4	6,9° (0,4 mm)	8,3° (0,5 mm)	8,8° (0,6 mm)	10,7° (0,7 mm)
> 4	≤ 6,3	6,5° (0,6 mm)	7,5° (0,7 mm)	5,2° (0,7 mm)	9,3° (0,8 mm)
> 6,3	≤ 10	4,8° (0,7 mm)	5,4° (0,8 mm)	5,7° (0,8 mm)	7,5° (1,0 mm)
> 10	≤ 16	3,2° (0,7 mm)	4,1° (0,9 mm)	4,7° (1,0 mm)	5,7° (1,3 mm)
> 16	≤ 25	2,6° (0,9 mm)	3,0° (1,1 mm)	3,2° (1,1 mm)	4,4° (1,6 mm)
> 25	≤ 40	2,2° (1,1 mm)	2,9° (1,6 mm)	3,0° (1,5 mm)	4,1° (2,2 mm)
> 40	≤ 63	1,9° (1,5 mm)	2,4° (2,1 mm)	2,6° (2,1 mm)	3,3° (2,8 mm)
> 63	≤ 100	1,4° (1,8 mm)	2,0° (2,6 mm)	2,0° (2,4 mm)	2,7° (3,6 mm)
> 100	≤ 160	1,0° (2,2 mm)	1,5° (3,2 mm)	1,4° (3,0 mm)	2,0° (4,3 mm)
> 160	≤ 250	0,8° (2,8 mm)	1,2° (4,0 mm)	1,2° (4,0 mm)	1,6° (5,5 mm)
> 250	≤ 400	0,7° (3,1 mm)	0,9° (5,0 mm)	0,9° (4,5 mm)	1,3° (6,8 mm)
> 400	≤ 630	0,5° (4,7 mm)	0,8° (6,5 mm)	0,7° (6,3 mm)	1,0° (8,7 mm)
> 630	≤ 1 000	0,5° (7,0 mm)	0,7° (9,0 mm)	0,7° (9,5 mm)	0,9° (12,5 mm)
> 1 000	≤ 1 600	0,4° (9,0 mm)	0,5° (11,5 mm)	0,5° (11,5 mm)	0,7° (14,5 mm)

Table 3 — Draft angles for machine moulding casting

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External	Internal	External	Internal
> 0	≤ 4	5,8° (0,4 mm)	6,8° (0,5 mm)	7,4° (0,5 mm)	8,6° (0,6 mm)
> 4	≤ 6,3	5,3° (0,5 mm)	6,0° (0,5 mm)	6,7° (0,6 mm)	7,5° (0,7 mm)
> 6,3	≤ 10	3,9° (0,5 mm)	4,4° (0,6 mm)	4,7° (0,7 mm)	6,0° (0,8 mm)
> 10	≤ 16	2,7° (0,6 mm)	3,2° (0,7 mm)	3,9° (0,9 mm)	4,5° (1,0 mm)
> 16	≤ 25	2,2° (0,8 mm)	2,5° (0,9 mm)	2,8° (1,0 mm)	3,5° (1,2 mm)
> 25	≤ 40	2,0° (1,1 mm)	2,4° (1,3 mm)	2,7° (1,5 mm)	3,3° (1,8 mm)
> 40	≤ 63	1,6° (1,4 mm)	1,9° (1,7 mm)	2,0° (1,8 mm)	2,6° (2,2 mm)
> 63	≤ 100	1,2° (1,7 mm)	1,6° (2,1 mm)	1,6° (2,2 mm)	2,2° (3,0 mm)
> 100	≤ 160	1,0° (2,3 mm)	1,3° (2,8 mm)	1,3° (2,9 mm)	1,8° (3,9 mm)
> 160	≤ 250	0,9° (3,0 mm)	1,1° (3,9 mm)	1,2° (4,1 mm)	1,6° (5,4 mm)
> 250	≤ 400	0,8° (4,3 mm)	1,0° (5,4 mm)	1,1° (5,8 mm)	1,4° (7,4 mm)
> 400	≤ 630	0,7° (6,2 mm)	0,9° (7,7 mm)	0,9° (7,9 mm)	1,1° (9,8 mm)
> 630	≤ 1 000	0,5° (7,0 mm)	0,7° (9,0 mm)	0,7° (9,5 mm)	0,9° (12,5 mm)
> 1 000	≤ 1 600	0,4° (9,0 mm)	0,5° (11,5 mm)	0,5° (11,5 mm)	0,7° (14,5 mm)

Table 4 — Draft angles for permanent moulding casting

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External draft value	Internal draft value	External draft value 2	Internal draft value 2
—	≤ 4	8,5° (0,3 mm)	11,3° (0,4 mm)	11,3° (0,4 mm)	11,3° (0,4 mm)
> 4	≤ 6,3	3,3° (0,3 mm)	5,6° (0,5 mm)	5,6° (0,5 mm)	5,6° (0,5 mm)
> 6,3	≤ 10	3,5° (0,5 mm)	4,9° (0,7 mm)	4,9° (0,7 mm)	5,6° (0,8 mm)
> 10	≤ 16	3,1° (0,7 mm)	1,4° (1,0 mm)	3,5° (0,8 mm)	5,3° (1,2 mm)
> 16	≤ 25	2,8° (1,0 mm)	3,9° (1,4 mm)	3,4° (1,2 mm)	4,5° (1,6 mm)

Table 4 (continued)

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External draft value	Internal draft value	External draft value 2	Internal draft value 2
> 25	≤ 40	2,5° (1,4 mm)	3,5° (2,0 mm)	3,2° (1,8 mm)	4,1° (2,3 mm)
> 40	≤ 63	2,2° (2,0 mm)	2,8° (2,5 mm)	2,8° (2,5 mm)	3,6° (3,2 mm)
> 63	≤ 100	1,8° (2,5 mm)	2,8° (4,0 mm)	2,5° (3,6 mm)	3,2° (4,5 mm)
> 100	≤ 160	1,8° (4,0 mm)	2,2° (5,0 mm)	1,6° (5,0 mm)	2,6° (6,0 mm)
> 160	≤ 250	1,7° (6,0 mm)	1,8° (6,5 mm)	2,0° (7,0 mm)	2,2° (8,0 mm)
> 250	≤ 400	1,4° (8,0 mm)	1,6° (9,0 mm)	1,6° (9,0 mm)	1,8° (10,0 mm)
> 400	≤ 630	1,2° (11,0 mm)	1,3° (12,0 mm)	1,3° (12,0 mm)	1,5° (13,0 mm)

Table 5 — Draft angles for pressure die casting

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External draft value	Internal draft value	External draft value 2	Internal draft value 2
—	≤ 4	5,7° (0,2 mm)	8,5° (0,3 mm)	8,5° (0,3 mm)	11,3° (0,4 mm)
> 4	≤ 6,3	2,2° (0,2 mm)	3,3° (0,3 mm)	3,3° (0,3 mm)	5,6° (0,5 mm)
> 6,3	≤ 10	2,1° (0,3 mm)	2,8° (0,4 mm)	2,8° (0,4 mm)	4,9° (0,7 mm)
> 10	≤ 16	1,3° (0,3 mm)	2,2° (0,5 mm)	2,2° (0,5 mm)	4,0° (0,9 mm)
> 16	≤ 25	2,8° (0,4 mm)	2,0° (0,7 mm)	2,0° (0,7 mm)	3,4° (1,2 mm)
> 25	≤ 40	2,5° (0,7 mm)	2,1° (1,2 mm)	2,1° (1,2 mm)	3,5° (2,0 mm)
> 40	≤ 63	2,2° (1,0 mm)	1,7° (1,5 mm)	1,7° (1,5 mm)	2,8° (2,5 mm)
> 63	≤ 100	0,8° (1,2 mm)	1,4° (2,0 mm)	1,4° (2,0 mm)	2,5° (3,5 mm)
> 100	≤ 160	0,9° (2,0 mm)	1,3° (3,0 mm)	1,3° (3,0 mm)	2,2° (5,0 mm)
> 160	≤ 250	0,7° (2,5 mm)	1,1° (4,0 mm)	1,1° (4,0 mm)	2,0° (7,0 mm)
> 250	≤ 400	0,5° (3,0 mm)	0,9° (5,5 mm)	0,9° (5,5 mm)	1,6° (9,0 mm)
> 400	≤ 630	0,5° (4,0 mm)	0,8° (7,0 mm)	0,8° (7,0 mm)	1,2° (11,0 mm)

Table 6 — Draft angles for investment casting

Nominal height range of feature for draft value		Grade A (DA)		Grade B (DB)	
		External draft value	Internal draft value	External draft value 2	Internal draft value 2
—	≤ 4	5,7° (0,2 mm)	5,7° (0,2 mm)	5,7° (0,2 mm)	8,5° (0,3 mm)
> 4	≤ 6,3	2,2° (0,2 mm)	2,2° (0,2 mm)	2,2° (0,2 mm)	3,3° (0,3 mm)
> 6,3	≤ 10	1,4° (0,2 mm)	1,4° (0,2 mm)	1,4° (0,2 mm)	2,8° (0,4 mm)
> 10	≤ 16	0,9° (0,2 mm)	1,3° (0,3 mm)	1,3° (0,3 mm)	1,8° (0,4 mm)
> 16	≤ 25	0,8° (0,3 mm)	1,1° (0,4 mm)	1,1° (0,4 mm)	1,4° (0,5 mm)
> 25	≤ 40	0,5° (0,3 mm)	0,7° (0,4 mm)	0,7° (0,4 mm)	1,1° (0,6 mm)
> 40	≤ 63	0,5° (0,4 mm)	0,6° (0,5 mm)	0,6° (0,5 mm)	0,8° (0,7 mm)
> 63	≤ 100	0,3° (0,4 mm)	0,4° (0,6 mm)	0,4° (0,6 mm)	0,6° (0,8 mm)
> 100	≤ 160	0,2° (0,5 mm)	0,3° (0,7 mm)	0,3° (0,7 mm)	0,4° (0,9 mm)
> 160	≤ 250	0,2° (0,6 mm)	0,2° (0,8 mm)	0,2° (0,8 mm)	0,3° (1,0 mm)
> 250	≤ 400	0,1° (0,7 mm)	0,2° (0,9 mm)	0,2° (0,9 mm)	0,2° (1,2 mm)
> 400	≤ 630	0,1° (0,8 mm)	0,1° (1,0 mm)	0,1° (1,0 mm)	0,2° (1,5 mm)

NOTE The overall dimension rating is finer than in [Tables 8 to 12](#) in order to avoid excess material.

7 Tolerance grades

7.1 General

Before using general tolerances, it is necessary to investigate whether, for functional reasons, smaller tolerances or, for economical reasons, larger tolerances are needed (see [Annex C](#)), i.e. the necessity to specify individual tolerances.

Individual dimensional and geometrical tolerances shall be indicated according to the relevant GPS standards on dimensional and geometrical tolerancing.

For drawings where the tolerances according to this document apply in a specified restrained condition only, ISO 10579 shall be referred to on the drawing.

7.2 Dimensional casting tolerance grades (DCTG)

Fifteen dimensional casting tolerance grades are defined and designated DCTG 1 to DCTG 15 (see [Table 7](#)).

NOTE 1 For wall thicknesses, see [Clause 9](#).

NOTE 2 This document does not cover general tolerances for angular dimensions. In the case of angular dimensions, the nominal dimension can be converted into linear dimensions.

NOTE 3 [Annex A](#) gives recommendations for the application of the tolerance grades from [Table 6](#).

As the default conditions for dimensions, the casting tolerance shall be symmetrically disposed with respect to the nominal dimension, i.e. with one half on the positive side and one half on the negative side.

If agreed between the manufacturer and the customer for specific reasons, the casting tolerance may be asymmetric. In such cases the casting tolerance shall be stated individually, according to ISO 129-1, following the nominal dimensions of the final moulded part.

NOTE 4 In pressure die casting an asymmetric tolerance disposition is often applied because of special technical reasons.

NOTE 5 In the case of a draft angle, the nominal dimension is modified by the draft angle (TP or TM).