INTERNATIONAL STANDARD

ISO 8062-3

Second edition
2023-02

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

Part 3: General dimensional and geometrical tolerances and machining allowances for castings using ± tolerances for indicated dimensions

Spécification géométrique des produits (GPS) — Tolérances dimensionnelles et géométriques des pièces moulées —

Partie 3: Tolérances dimensionnelles et géométriques générales et surépaisseurs d'usinage pour les pièces moulées utilisant des tolérances ± pour les dimensions indiquées

Reference number
ISO 8062-3:2023(E)

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Published in Switzerland

Contents

Page

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).

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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, *Foundry technology*, 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 ± 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.

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 ± tolerances for indicated dimensions

1 Scope

This document specifies general dimensional and geometrical tolerances as well as machining allowance grades for castings using ± 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,[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

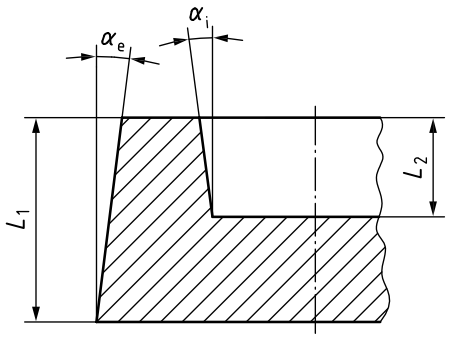
3.2
external draft value
draft angle (3.1) on a surface that has no opposite surface in the direction outward of the part

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

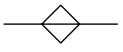
4 Abbreviated terms

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
SG	spheroidal graphite
SMI	surface mismatch
TM	taper minus
TP	taper plus

5 Taper

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

There are three possibilities to indicate taper:

a) the taper is already included in the nominal model;

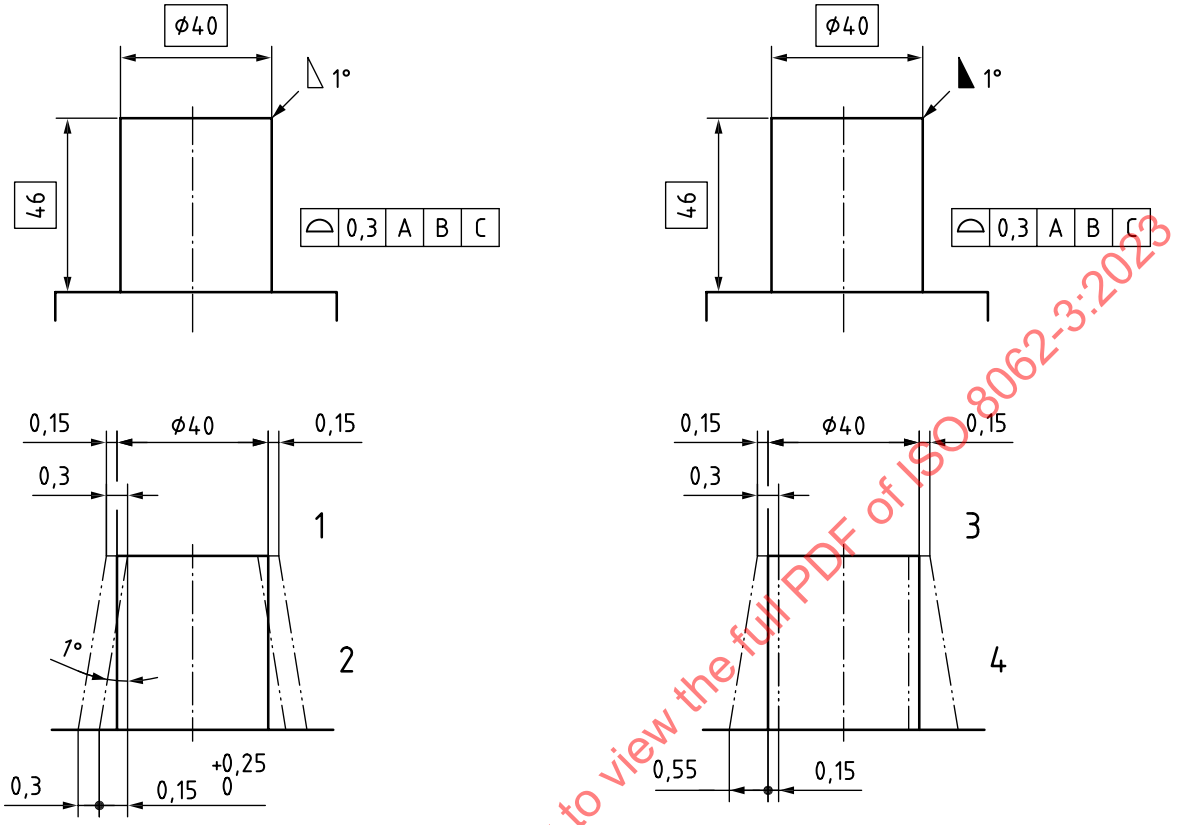
b) the taper is indicated by the symbol  ;

c) 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 Ø40 → Ø40,8
3 tolerance gradually increased 0,3 → 0,7
4 ideal shape constant Ø40

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 11, 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).

Table 7 — Linear dimensional casting tolerances (DCT)

Dimensions in millimetres

Nominal dimensions related to the moulded part		Linear dimensional tolerance for dimensional casting tolerance grade (DCTG)[a]															
		DCTG 1	DCTG 2	DCTG 3	DCTG 4	DCTG 5	DCTG 6	DCTG 7	DCTG 8	DCTG 9	DCTG 10	DCTG 11	DCTG 12	DCTG 13	DCTG 14	DCTG 15	DCTG 15wt[b]
–	≤ 10	0,09	0,13	0,18	0,26	0,36	0,52	0,74	1	1,5	2	2,8	4,2	–	–	–	–
> 10	≤ 16	0,1	0,14	0,2	0,28	0,38	0,54	0,78	1,1	1,6	2,2	3	4,4	–	–	–	–
> 16	≤ 25	0,11	0,15	0,22	0,3	0,42	0,58	0,82	1,2	1,7	2,4	3,2	4,6	6	8	10	12
> 25	≤ 40	0,12	0,17	0,24	0,32	0,46	0,64	0,9	1,3	1,8	2,6	3,6	5	7	9	11	14
> 40	≤ 63	0,13	0,18	0,26	0,36	0,5	0,7	1	1,4	2	2,8	4	5,6	8	10	12	16
> 63	≤ 100	0,14	0,2	0,28	0,4	0,56	0,78	1,1	1,6	2,2	3,2	4,4	6	9	11	14	18
> 100	≤ 160	0,15	0,22	0,3	0,44	0,62	0,88	1,2	1,8	2,5	3,6	5	7	10	12	16	20
> 160	≤ 250	–	0,24	0,34	0,5	0,7	1	1,4	2	2,8	4	5,6	8	11	14	18	22
> 250	≤ 400	–	–	0,4	0,56	0,78	1,1	1,6	2,2	3,2	4,4	6,2	9	12	16	20	25
> 400	≤ 630	–	–	–	0,64	0,9	1,2	1,8	2,6	3,6	5	7	10	14	18	22	28
> 630	≤ 1 000	–	–	–	–	1	1,4	2	2,8	4	6	8	11	16	20	25	32
> 1 000	≤ 1 600	–	–	–	–	–	1,6	2,2	3,2	4,6	7	9	13	18	23	29	37
> 1 600	≤ 2 500	–	–	–	–	–	–	2,6	3,8	5,4	8	10	15	21	26	33	42
> 2 500	≤ 4 000	–	–	–	–	–	–	–	4,4	6,2	9	12	17	24	30	38	49
> 4 000	≤ 6 300	–	–	–	–	–	–	–	–	7	10	14	20	28	35	44	56
> 6 300	≤ 10 000	–	–	–	–	–	–	–	–	–	11	16	23	32	40	50	64

[a] For wall thicknesses in grade DCTG 1 to DCTG 15, one grade coarser applies (see Clause 9).

[b] Grade DCTG 15wt (wall thickness) exists only for wall thicknesses of castings generally specified to DCTG 15.

7.3 Geometrical casting tolerance grades (GCTG)

7.3.1 General

Seven geometrical casting tolerance grades (GCTG) are defined and designated GCTG 2 to GCTG 8 (see Tables 8 to 11).

NOTE GCT values are not given for grade GCTG 1. This grade is reserved for finer values which might be required in the future.

General tolerances on form (straightness of median lines, flatness, roundness) and on orientation (parallelism, perpendicularity) do not apply to features with draft angle (taper). Where required, these features shall have individually indicated tolerances according to the function and the manufacturer's advice.

Other geometrical tolerances than those given in Tables 8 to 11 (e.g. profile, position, combined zone flatness) shall be indicated individually.

Therefore, it is recommended that information about the design of the mould regarding the location of the parting surfaces and the amount of draft angle applied to the features is acquired from the manufacturer in order to complete the drawing.

For tolerances of axes, the nominal length of the axis shall be taken. For tolerances of median surfaces, the larger nominal length of the median surface shall be taken.

7.3.2 Nominal dimensions

The nominal dimension to be used in Tables 8 to 11 shall be the longest nominal dimension of the considered 2D integral feature of the moulded part, disregarding the nominal dimension of non-individually indicated fillets and chamfers (see examples in Annex E).

NOTE 1 Integral feature (see ISO 17450-1) means the real surface which can be touched physically. The longest nominal dimension in the case of a cylinder is either diameter or length; in the case of a rectangular planar surface it is the longest side.

NOTE 2 This definition is not applicable for 3D shapes, for example complex features.

NOTE 3 In certain cases, for example short cylinders or cones with large diameters, the resultant tolerance can be unrealistic, therefore individual tolerancing will possibly be required.

7.3.3 Datums

7.3.3.1 Datums for general parallelism and perpendicularity tolerances

For general parallelism and perpendicularity tolerances according to this document, a datum system shall be specified on the drawing and identified by the indication "ISO 8062-3 DS" in or near the title block of the drawing, as shown in Figure 3.

a) Option 1 **b) Option 2**

Figure 3 — Drawing indication options for the datum system for general parallelism and perpendicularity tolerances according to this document

NOTE This datum system does not apply to general geometrical tolerances on coaxiality and symmetry, see 7.3.3.2 and 7.3.3.3.

7.3.3.2 Datums for general coaxiality tolerances

For datums of general coaxiality tolerances the following applies:

— If one cylindrical feature (internal or external) extends over the whole length of all other cylindrical coaxial features, this feature axis applies as the (single) datum, see Annex D, Figure D.1.

— Otherwise, a common datum applies, composed of the axes of the two most separated features on the considered drawing centre line, see Annex D, Figure D.2. If more than one possibility exists (e.g. inner or outer features), the feature with the largest diameter applies, see Annex D, Figure D.3.

The general tolerances for coaxiality apply also to the datum features themselves, if a common datum applies.

7.3.3.3 Datums for general symmetry tolerances

For datums of general symmetry tolerances the following applies:

— If one feature of size (internal or external), composed of two parallel opposite planes, extends over the whole length of all other co-symmetrical features, this feature median plane applies as the (single) datum, see Annex D, Figure D.4.

— Otherwise, a common datum applies, composed of the median planes of the two most separated features on the considered drawing centre line (plane), see Annex D, Figure D.5. If more than one possibility exists, the feature with the largest size applies, see Annex D, Figure D.6. One of the two datum features may be cylindrical, see Annex D, Figure D.7.

The general tolerances for symmetry apply also to the datum features themselves, if a common datum applies.

Table 8 — Casting tolerances for straightness of median lines

Dimensions in millimetres

Nominal dimension of the considered integral feature		Straightness tolerance for geometrical casting tolerance grade (GCTG)						
		GCTG 2	GCTG 3	GCTG 4	GCTG 5	GCTG 6	GCTG 7	GCTG 8
	≤ 10	0,08	0,12	0,18	0,27	0,4	0,6	0,9
> 10	≤ 30	0,12	0,18	0,27	0,4	0,6	0,9	1,4
> 30	≤ 100	0,18	0,27	0,4	0,6	0,9	1,4	2
> 100	≤ 300	0,27	0,4	0,6	0,9	1,4	2	3
> 300	≤ 1 000	0,4	0,6	0,9	1,4	2	3	4,5
> 1 000	≤ 3 000	—	—	—	3	4	6	9
> 3 000	≤ 6 000	—	—	—	6	8	12	18
> 6 000	≤ 10 000	—	—	—	12	16	24	36

Table 9 — Casting tolerances for flatness

Dimensions in millimetres

Longest nominal dimension of the considered integral feature		Flatness tolerance for geometrical casting tolerance grade (GCTG)						
		GCTG 2	GCTG 3	GCTG 4	GCTG 5	GCTG 6	GCTG 7	GCTG 8
	≤ 10	0,12	0,18	0,27	0,4	0,6	0,9	1,4
> 10	≤ 30	0,18	0,27	0,4	0,6	0,9	1,4	2
> 30	≤ 100	0,27	0,4	0,6	0,9	1,4	2	3
> 100	≤ 300	0,4	0,6	0,9	1,4	2	3	4,5
> 300	≤ 1 000	0,6	0,9	1,4	2	3	4,5	7
> 1 000	≤ 3 000	—	—	—	4	6	9	14
> 3 000	≤ 6 000	—	—	—	8	12	18	28
> 6 000	≤ 10 000	—	—	—	16	24	36	56

Table 10 — Casting tolerances for roundness, parallelism, perpendicularity and symmetry

Dimensions in millimetres

Longest nominal dimension of the considered integral feature		Tolerance for geometrical casting tolerance grade (GCTG)						
		GCTG 2	GCTG 3	GCTG 4	GCTG 5	GCTG 6	GCTG 7	GCTG 8
	≤ 10	0,18	0,27	0,4	0,6	0,9	1,4	2
> 10	≤ 30	0,27	0,4	0,6	0,9	1,4	2	3
> 30	≤ 100	0,4	0,6	0,9	1,4	2	3	4,5
> 100	≤ 300	0,6	0,9	1,4	2	3	4,5	7
> 300	≤ 1 000	0,9	1,4	2	3	4,5	7	10
> 1 000	≤ 3 000	—	—	—	6	9	14	20
> 3 000	≤ 6 000	—	—	—	12	18	28	40
> 6 000	≤ 10 000	—	—	—	24	36	56	80

Table 11 — Casting tolerances for coaxiality (cylindrical tolerance zone)

Dimensions in millimetres

Longest nominal dimension of the considered integral feature		Coaxiality tolerance for geometrical casting tolerance grade (GCTG)						
		GCTG 2	GCTG 3	GCTG 4	GCTG 5	GCTG 6	GCTG 7	GCTG 8
	≤ 10	0,27	0,4	0,6	0,9	1,4	2	3
> 10	≤ 30	0,4	0,6	0,9	1,4	2	3	4,5
> 30	≤ 100	0,6	0,9	1,4	2	3	4,5	7
> 100	≤ 300	0,9	1,4	2	3	4,5	7	10
> 300	≤ 1 000	1,4	2	3	4,5	7	10	15
> 1 000	≤ 3 000	—	—	—	9	14	20	30
> 3 000	≤ 6 000	—	—	—	18	28	40	60
> 6 000	≤ 10 000	—	—	—	36	56	80	120

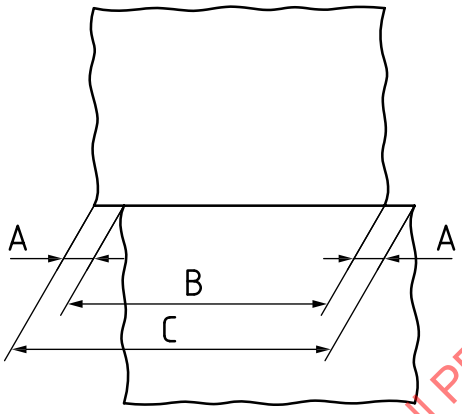
Other geometrical tolerances shall be indicated by individually indicated geometrical tolerances.

8 Surface mismatch (SMI)

As default condition, the surface mismatch is controlled by the tolerances applied to linear dimensions in accordance with Table 7, see Figure 4, therefore the surface mismatch may vary between zero and the value given in Table 7, depending on the actual local sizes of the feature.

On features without draft angle, surface mismatch is also controlled and therefore included in form tolerances for straightness, flatness and roundness, as applicable, given in Tables 8 to 10.

NOTE This is an overruling of the principle of independency. This is because it is often not known whether a parting line exists and, if it does, whether the particular feature is affected.



Key

A surface mismatch
B lower limit of size
C upper limit of size

Figure 4 — Limitation of surface mismatch by linear dimension

If it is necessary to restrict further the value of the SMI, the maximum permissible SMI shall be stated individually according to ISO 10135.

9 Wall thickness

As the default condition, the tolerance for wall thickness in grades DCTG 1 to DCTG 15 shall be one grade coarser than the general tolerance for other dimensions; for example, if there is a general tolerance on a drawing of DCTG 10, the tolerance on wall thicknesses shall be DCTG 11.

10 Required machining allowances (RMA)

10.1 General

As a general condition, the specified RMAG according to this document (see Clause 11) applies for the entire final moulded part, i.e. only one value is specified for all surfaces to be machined, and this value shall be selected from the appropriate dimension range in accordance with the largest overall dimension (see Table 12).

In sand casting, top surfaces might need more machining allowance than other surfaces. For these surfaces coarser RMAGs can be selected. Individual machining allowances shall be indicated according to ISO 1302.

10.2 Required machining allowance grades (RMAG)

Ten required machining allowance grades are defined and designated RMAG A to RMAG K (see Table 12).

NOTE Grades recommended for particular alloys and manufacturing methods are shown in Table B.1 for information only.

Table 12 — Required machining allowance

Dimensions in millimetres

Largest overall dimension		Machining allowance for required machining allowance grade (RMAG)									
		RMAG A	RMAG B	RMAG C	RMAG D	RMAG E	RMAG F	RMAG G	RMAG H	RMAG J	RMAG K
—	≤ 40	0,1	0,1	0,2	0,3	0,4	0,5	0,5	0,7	1	2
> 40	≤ 63	0,1	0,2	0,3	0,3	0,4	0,5	0,7	1	1,4	3
> 63	≤ 100	0,2	0,3	0,4	0,5	0,7	1	1,4	2	2,8	4
> 100	≤ 160	0,3	0,4	0,5	0,8	1,1	1,5	2,2	3	4	6
> 160	≤ 250	0,3	0,5	0,7	1	1,4	2	2,8	4	5,5	8
> 250	≤ 400	0,4	0,7	0,9	1,3	1,8	2,5	3,5	5	7	10
> 400	≤ 630	0,5	0,8	1,1	1,5	2,2	3	4	6	9	12
> 630	≤ 1 000	0,6	0,9	1,2	1,8	2,5	3,5	5	7	10	14
> 1 000	≤ 1 600	0,7	1	1,4	2	2,8	4	5,5	8	11	16
> 1 600	≤ 2 500	0,8	1,1	1,6	2,2	3,2	4,5	6	9	13	18
> 2 500	≤ 4 000	0,9	1,3	1,8	2,5	3,5	5	7	10	14	20
> 4 000	≤ 6 300	1	1,4	2	2,8	4	5,5	8	11	16	22
> 6 300	≤ 10 000	1,1	1,5	2,2	3	4,5	6	9	12	17	24
Grades A and B shall only be applied in special cases, for example with series production in which the pattern equipment, the casting procedure and the machining procedure with regard to clamping surfaces and datum surfaces or targets have been agreed between the customer and the foundry.											

11 Indication on drawings

11.1 Indication of general DCTs

General casting tolerances according to this document shall be indicated on the drawing in or near the title block in the following ways:

a) With general information relating to tolerances:

— "General tolerances";

— "ISO 8062-3";

— the DCTG in accordance with Table 7.

EXAMPLE General tolerances ISO 8062-3: DCTG 12.

b) If further restriction of the SMI is required (see Clause 8):

— "General tolerances";

— "ISO 8062-3";

— the DCTG in accordance with Table 7;

— “maximum surface mismatch” and its required limit value according to ISO 10135.

EXAMPLE General tolerances ISO 8062-3: DCTG 12 – SMI ± 1,5.

NOTE For more information see Annexes A and C.

11.2 Indication of machining allowances

RMAs shall be indicated on the drawing in or near the title block in the following ways:

a) With general information relating to tolerances and RMAs:

— “General tolerances”;

— “ISO 8062-3”;

— the DCTG according to Table 7;

— the RMA according to Table 12 and the corresponding grade in brackets.

EXAMPLE For a RMA of 6 mm in grade H for a casting in the largest dimension range over 400 mm and up to 630 mm (with general tolerance for the casting ISO 8062-3: DCTG 12):

General tolerances ISO 8062-3: DCTG 12 – RMA 6 (RMAG H).

b) Where a local machining allowance is required on a surface of the moulded part, it shall be specified individually according to ISO 1302, as shown in Figure 5.

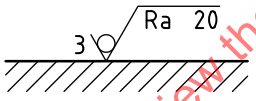


Figure 5 — Indication of required machining allowance on individual surfaces

NOTE For more information see Annex B.

11.3 Indication of geometrical casting tolerances (GCTs)

GCTs according to this document shall be stated on the drawing in one of the following ways:

a) If general tolerances according to this document apply in conjunction with the general casting tolerances in accordance with Table 7, the following information shall be indicated in or near the title block:

— “General tolerances”;

— “ISO 8062-3”;

— the DCTG in accordance with Table 7;

— the RMA in accordance with Table 12, and the corresponding grade in brackets;

— the GCTG in accordance with Tables 8 to 11.

EXAMPLE General tolerances ISO 8062-3: DCTG 12 – RMA 6 (RMAG H) – GCTG 7.

b) For general GCTs in accordance with Tables 8 to 11:

EXAMPLE General tolerances ISO 8062-3: GCTG 7.

For the concept of general tolerancing, see Annex C. For the selection of general tolerance grades, see Introduction and Annex A. For the selection of RMAG, see Annex B.

12 Rejection

Unless otherwise stated (e.g. in the documentation between customer and manufacturer), workpieces not meeting the general tolerances should not lead to automatic rejection. Such non-conformities should be discussed between the customer and the manufacturer (e.g. to ensure the workpiece function is not impaired, see C.4).

Annex A
(informative)

Dimensional and geometrical tolerances for castings

A.1 Casting processes

Tables A.1 and A.2 show dimensional tolerances and Table A.3 shows geometrical tolerance grades which can normally be expected in casting processes. As indicated in the Introduction, the accuracy of a casting process is dependent upon many factors, including:

a) complexity of the design;

b) type of pattern equipment or die equipment;

c) the metal or alloy concerned;

d) the condition of patterns or dies;

e) the foundry working methods.

A.2 Long series production

For long series of repetitive work, it can be possible to make adjustments and to control core positions carefully to achieve dimensional tolerance grades finer than those indicated in Table A.1.

A.3 Short series production

In sand casting for short production series and for single castings, it is generally impractical and uneconomical to use metal patterns and to develop equipment and casting procedures resulting in narrow tolerances. The wider tolerances for this class of manufacture are shown in Table A.2.

A.4 Dimensional linear tolerances

Dimensional tolerances in Table 7 are based on foundry experience data:

— $\sqrt{2}$ for grades DCTG 1 to DCTG 13;

— $\sqrt[3]{2}$ for grades DCTG 13 to DCTG 16.

Many dimensions of a casting are affected by the presence of a mould joint or a core, requiring increased dimensional tolerance. Since the designer will not necessarily be aware of the mould and core layout to be used, increases have already been included in Table 7.

A.5 Geometrical tolerances

Geometrical tolerances in Tables 8 to 11 are based on foundry experience data.

Table A.1 — Dimensional casting tolerance grades for long-series production raw castings

Method	Dimensional casting tolerance grade (DCTG) for casting material								
	Steel	Grey cast iron	SG cast iron	Malleable cast iron	Copper alloys	Zinc alloys	Light metal alloys	Nickel-based alloys	Cobalt-based alloys
Sand cast, hand moulding	11 to 14	11 to 14	11 to 14	11 to 14	10 to 13	10 to 13	9 to 12	11 to 14	11 to 14
Sand cast, machine moulding and shell moulding	8 to 12	8 to 12	8 to 12	8 to 12	8 to 10	8 to 10	7 to 9	8 to 12	8 to 12
Metallic permanent mould (except pressure die casting)		7 to 9	7 to 9	7 to 9	7 to 9	7 to 9	6 to 8		
Pressure die casting					6 to 8	3 to 6	[b]		
Investment casting	[a]	[a]	[a]		[a]		[a]	[a]	[a]

NOTE The tolerance grades indicated are those which can normally be held for castings produced in long series and if production factors influencing the dimensional accuracy of the casting have been fully developed.

[a] For investment castings, the following apply depending on the largest overall dimension:

≤ 100 mm: grade 4 to 6;

> 100 mm to ≤ 400 mm: grade 4 to 8;

> 400 mm: grade 4 to 9.

[b] The largest overall dimension strongly influences the choice of the tolerance class. The following casting tolerance grades are recommended for largest overall dimension, dimensional tolerance grade DCTG:

≤ 50 mm: DCTG 6;

> 50 mm to ≤ 180 mm: DCTG 7;

> 180 mm to ≤ 500 mm: DCTG 8;

> 500 mm: DCTG 9.

For complex castings, one grade coarser is recommended.

Table A.2 — Dimensional casting tolerance grades for short-series or single-production raw castings

Method	Moulding material	Dimensional casting tolerance grade (DCTG) for casting material							
		Steel	Grey cast iron	SG cast iron	Malleable cast iron	Copper alloys	Light metal alloys	Nickel-based alloys	Cobalt-based alloys
Sand cast, hand moulding	Clay-bonded	13 to 15	13 to 15	13 to 15	13 to 15	13 to 15	11 to 13	13 to 15	13 to 15
	Chemically bonded	12 to 14	11 to 14	11 to 14	11 to 14	10 to 13	10 to 13	12 to 14	12 to 14

NOTE The values in this table apply generally to nominal dimensions > 25 mm. For smaller dimensions, finer tolerances can normally be economically and practically held as follows:

— nominal dimension ≤ 10 mm: three grades finer;

— nominal dimensions > 10 mm to ≤ 16 mm: two grades finer;

— nominal dimensions > 16 mm to ≤ 25 mm: one grade finer.

Table A.3 — Geometrical casting tolerances grades

Method	Geometrical casting tolerance grade (GCTG) for casting material								
	Steel	Grey cast iron	SG cast iron	Malleable cast iron	Copper alloys	Zinc alloys	Light metal alloys	Nickel-based alloys	Cobalt-based alloys
Sand cast, hand moulding	6 to 8	5 to 7	5 to 7	5 to 7	5 to 7	5 to 7	5 to 7	6 to 8	6 to 8
Sand cast, machine moulding and shell moulding	5 to 7	4 to 6	4 to 6	4 to 6	4 to 6	4 to 6	4 to 6	5 to 7	5 to 7
Metallic permanent mould (except pressure die casting)					3 to 5		3 to 5		
Pressure die casting[b]					2 to 4	2 to 4	2 to 4		
Investment casting	[a]	3 to 5	3 to 5	3 to 5	3 to 5	2 to 4	3 to 5	[a]	[a]

[a] For investment castings, the following apply depending on the largest overall dimension:

up to and including 100 mm: grade 4 to 6;

above 100 mm up to and including 400 mm: grade 4 to 8;

above 400 mm: grade 4 to 9.

[b] For pressure die castings, the following apply:

grade GCTG 2 should only be used by special agreement;

grade GCTG 3: ordinary castings without side sliders for the contour;

grade GCTG 4: complex castings as well as castings with side sliders for the contour.

Annex B
(informative)

Required machining allowance grades (RMAG)

RMA grades recommended for particular metals and alloys and manufacturing methods are presented in Table B.1.

Table B.1 — Typical required machining allowance grades for raw castings

Method	Required machining allowance grade (RMAG) for casting material								
	Steel	Grey cast iron	SG cast iron	Malleable cast iron	Copper alloys	Zinc alloys	Light metal alloys	Nickel-based alloys	Cobalt-based alloys
Sand cast, hand moulding	G to K	F to H[a]	F to H[a]	F to H	F to H	F to H	F to H[a]	G to K	G to K
Sand cast, machine moulding and shell moulding	F to H	E to G	E to G	E to G	E to G	E to G	E to G	F to H	F to H
Metallic permanent mould (except pressure die casting)	—	D to F	D to F	D to F	D to F	D to F	D to F	—	—
Pressure die casting	—	—	—	—	B to D	A to D	B to D	—	—
Investment casting	E	E	E	—	E	—	E	E	E

[a] For castings with largest overall dimension greater than 6 300 mm, F to K applies.

Annex C
(informative)

Concept of general tolerancing of characteristics

C.1 Indication

General tolerances should be indicated on the drawing with a reference to this document in accordance with Clause 11.

The values of general tolerances correspond to grades of customary foundry accuracy, the appropriate tolerance grade being selected and indicated on the drawing.

C.2 Tolerance setting according to feature size

For certain tolerance values which correspond to the customary foundry accuracy, there is usually no gain in manufacturing economy by enlarging the tolerance. In any event, foundry machinery and the usual foundry skill normally do not manufacture features with greater deviations. For example, a feature 150 mm ± 1,8 mm in diameter and 350 mm long manufactured in a foundry with a customary accuracy equal to or finer than GCTG 6 contains the geometrical deviations well within 4,5 mm for roundness, 2 mm for straightness of surface elements (the values given have been taken from Table 10 for roundness and Table 8 for straightness). Specifying larger tolerances would be of no benefit in foundries.

However, if, for functional reasons, a feature requires a smaller tolerance value than the general tolerances, then the feature should have the smaller tolerance indicated individually adjacent to the particular feature. This type of tolerance falls outside the scope of general tolerances.

In cases where the function of a feature allows a casting tolerance equal to or larger than the general tolerance values, this should not be individually indicated, but should be stated on the drawing as described in Clause 11. This type of tolerance allows full use of the concept of general tolerancing.

There will be exceptions to the rule, where the function allows a larger tolerance than the general tolerances, and the larger tolerance will provide a gain in manufacturing economy. In these special cases, the larger casting tolerance should be indicated individually adjacent to the particular feature, for example the roundness tolerance of a large and thin ring.

C.3 Advantages of applying general tolerances

Using general tolerances can lead to the following advantages:

a) drawings are easier to read and thus communication is made more effective to the user of the drawing;

b) the designer saves time by avoiding detailed tolerance calculations as it is sufficient only to know that the function allows a tolerance greater than or equal to the general tolerance;

c) the drawing readily indicates which features can be produced by normal process capability, which also assists quality engineering by reducing inspection levels;

d) those features remaining, which have individually indicated casting tolerances, will, for the most part, be those controlling features for which the function requires relatively small tolerances and which therefore could cause special effort in the production – this will be helpful for production planning and will assist quality control services in their analysis of inspection requirements;

e) purchasers can negotiate orders more readily since the customary foundry accuracy is known before the contract is placed; this also avoids, as far as possible, arguments regarding delivery between the buyer and the supplier, since in this respect the drawing is complete.

These advantages are fully obtained only if there is sufficient reliability that the general dimensional as well as geometrical tolerances and RMA will not be exceeded, i.e. if the customary foundry accuracy of the particular foundry is equal to or finer than the general tolerances indicated in the drawing.

The foundry should, therefore:

— determine by measurements what its customary foundry accuracy is;

— accept only those drawings having general tolerances equal to or greater than its customary foundry accuracy;

— determine by prototype inspection, pre-production sampling and production sampling that its customary foundry accuracy does not deteriorate (it is not the intention of the concept of general tolerancing to check every feature on every casting).

Relying on undefined good foundry with all its uncertainties and misunderstandings is no longer necessary with the concept of general tolerances. The general tolerances define the required accuracy of good foundry.

C.4 Cases of apparent non-conformity with general tolerances

The tolerance that the function allows is often greater than the general tolerance. The function of the parts is, therefore, not always impaired if the general tolerance is (occasionally) exceeded at any feature of the casting. Additional material may not impair the function of the part. Before a rejection the designer or customer should verify whether the function is impaired and the casting is acceptable.

Not meeting the general tolerance should only lead to a rejection of the casting if the function is impaired.

C.5 Inspection of general tolerances

It is not the intention of the concept of general tolerances, according to this document, to inspect each general tolerance on each casting because it is unlikely that the general tolerance will be exceeded.

Annex D
(informative)

Datums for general geometrical tolerances

This annex illustrates various cases of datums for the general geometrical tolerances in accordance with 7.3.3.

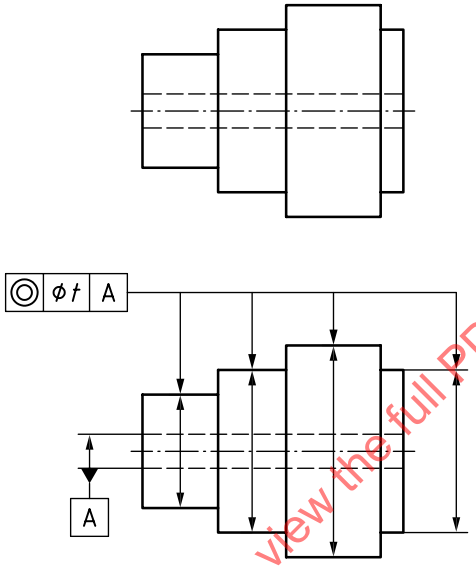


Figure D.1 — Drawing and meaning of general coaxiality tolerances, single datum

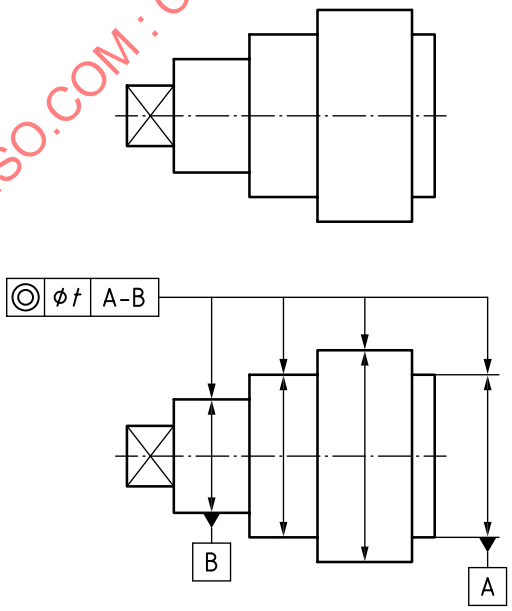


Figure D.2 — Drawing and meaning of general coaxiality tolerances, common datum

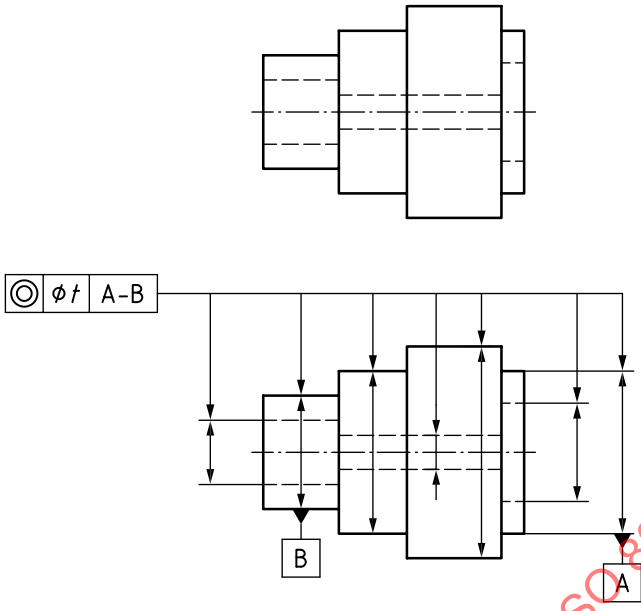


Figure D.3 — Drawing and meaning of general coaxiality tolerances, common datum with the largest diameter (in this case the outer cylinder)

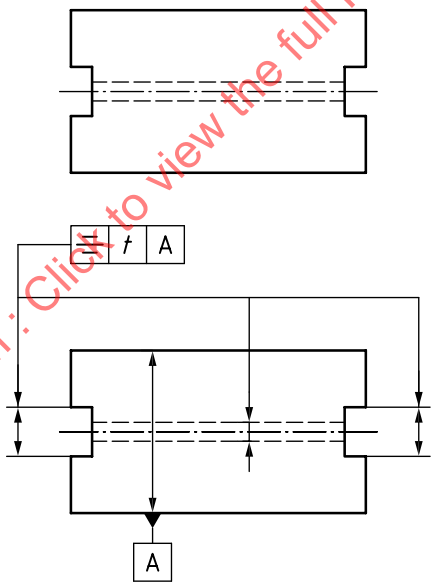


Figure D.4 — Drawing and meaning of general symmetry tolerances, single datum

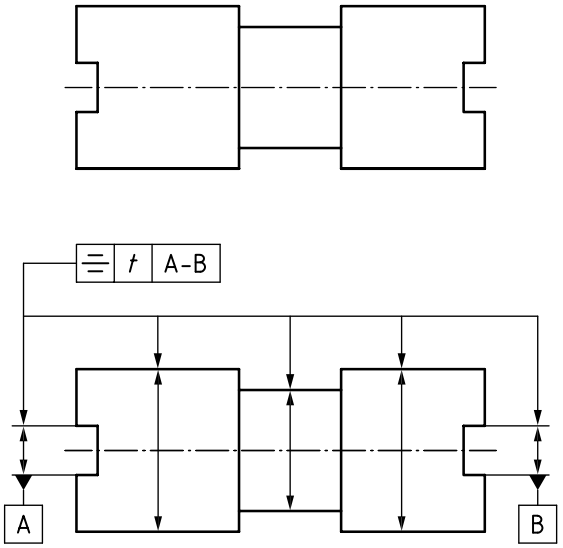


Figure D.5 — Drawing and meaning of general symmetry tolerances, common datum

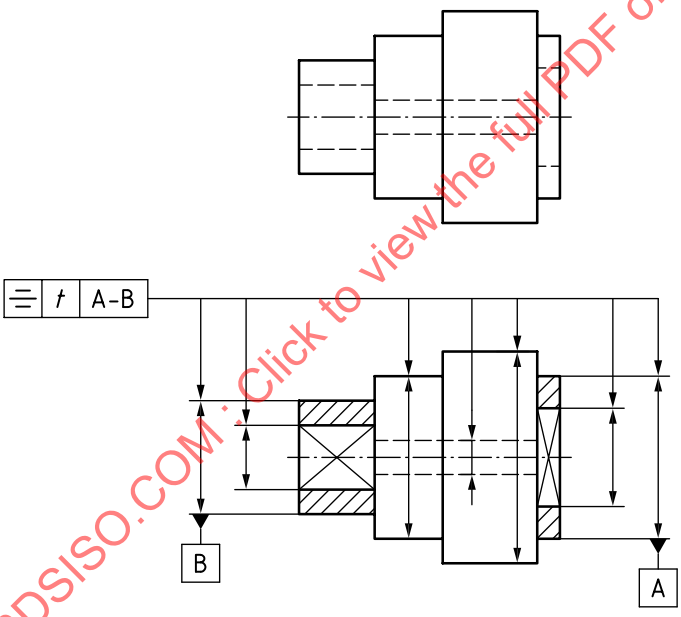


Figure D.6 — Drawing and meaning of general symmetry tolerances, common datum with the largest sizes

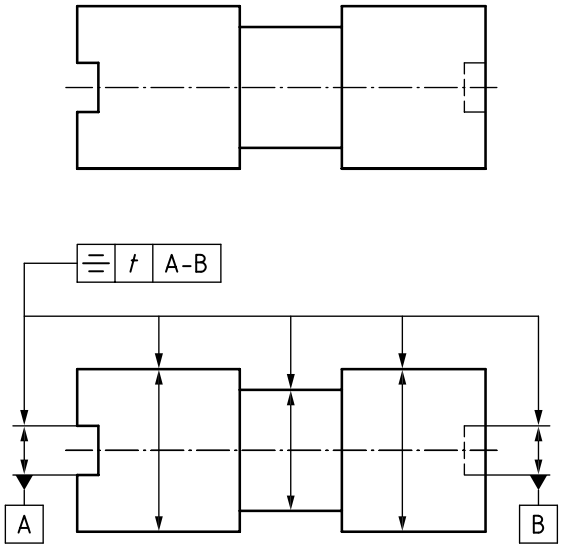


Figure D.7 — Drawing and meaning of general symmetry tolerances, common datum, one datum cylindrical

Annex E
(informative)

Application of general geometrical tolerances for castings

E.1 General

The general tolerances apply to all final moulded features without individual indicated geometrical tolerances which limit the concerned deviations, if this document is referred to on the drawing.

The general form tolerances apply without reference to the datum.

The general orientation tolerances apply with reference to the datum system as described in 7.3.3.1.

The general location tolerances (coaxiality, symmetry) apply with reference to datums as described in 7.3.3.2, 7.3.3.3 and Annex D.

This annex gives an example for the application of general geometrical tolerances for final moulded castings, using the example of Figure E.1. The following examples use the grade GCTG 6. In the following examples the parting surface is not indicated. The geometrical tolerances apply only to surfaces without tapers. Depending on the position of the parting surface, tolerances on surfaces would change. These surfaces should be toleranced individually.

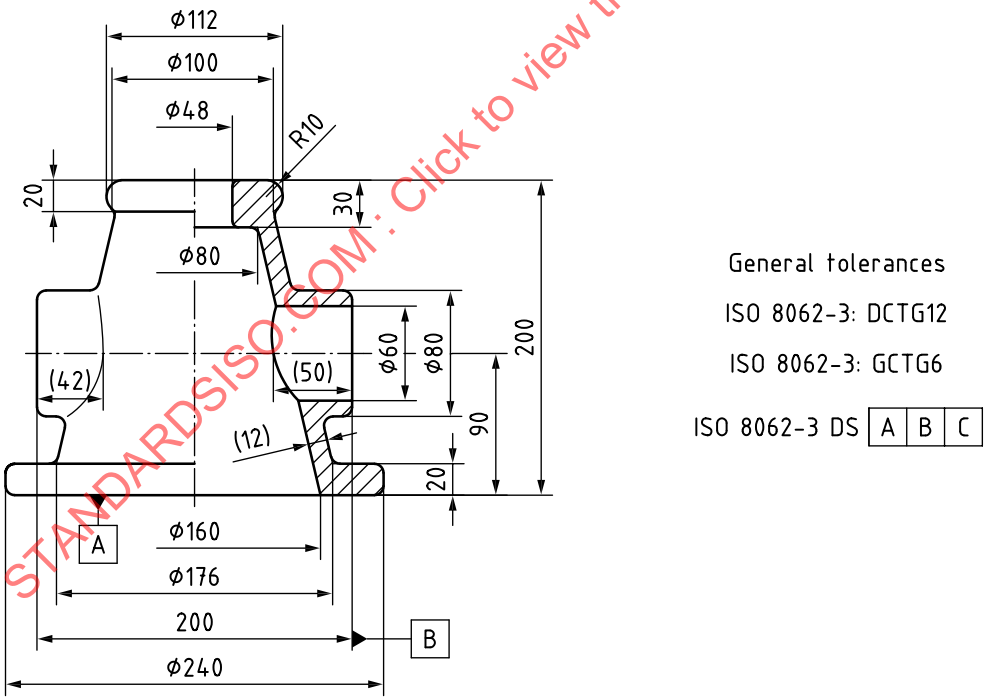


Figure E.1 — Example of drawing indication of a final moulded casting

E.2 Form tolerance

E.2.1 Straightness tolerance

General straightness tolerances are applied to eight features in Figure E.2. The tolerance values are selected from Table 8.

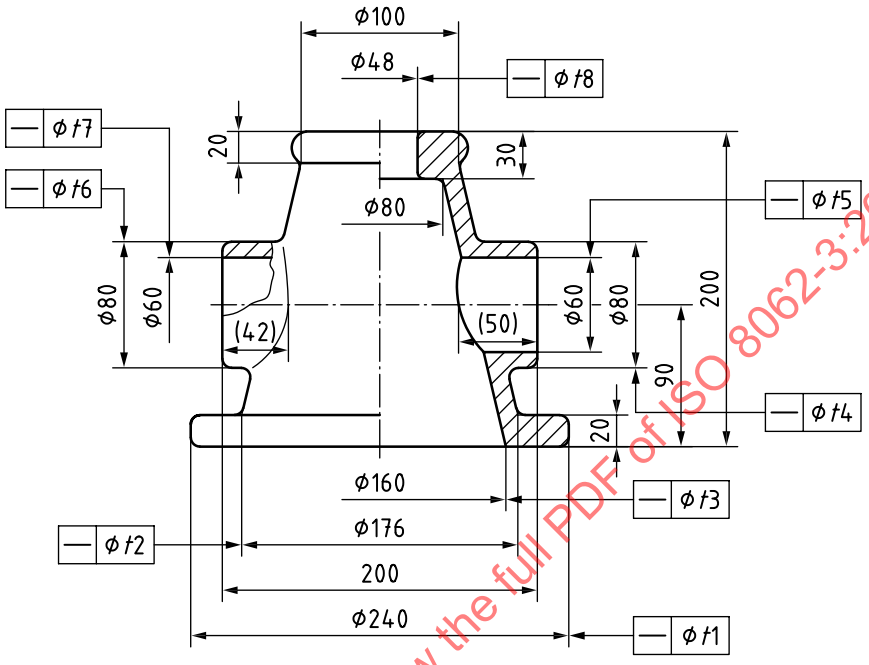


Figure E.2 — Interpretation of general straightness tolerances

a) Axis of external cylinder of bottom flange (longest nominal dimension is Ø 240 mm). *t*1 is 1,4 mm.

b) Axis of external cone (longest nominal dimension is Ø 176 mm). *t*2 is 1,4 mm.

c) Axis of internal cone [longest nominal dimension is 170 mm, i.e. 200 mm – 30 mm (top)]. *t*3 is 1,4 mm.

d) Axes of two horizontal and external cylinders (longest nominal dimension is Ø 80 mm). *t*4 and *t*6 are 0,9 mm.

NOTE 1 If a common tolerance zone is required for the axes of the horizontal and external cylinders, a straightness tolerance is indicated individually by the symbol CZ according to ISO 1101.

e) Axes of horizontal holes (longest nominal dimension is Ø 60 mm). *t*5 and *t*7 are 0,9 mm.

NOTE 2 If a common tolerance zone is required for the axes of the horizontal holes, a straightness tolerance is indicated by the symbol CZ according to ISO 1101.

f) Axis of hole of top part (longest nominal dimension is Ø 48 mm). *t*8 is 0,9 mm.

E.2.2 Flatness tolerance

General flatness tolerances are applied to six features in Figure E.3. The tolerance values are selected from Table 9.