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Castings — System of dimensional tolerances and machining allowances

*Pièces moulées — Système de tolérances dimensionnelles et
surépaisseurs d'usinage*
(standards.iteh.ai)

ISO 8062:1994

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Reference number
ISO 8062:1994(E)

Foreword

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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.

International Standard ISO 8062 was prepared by Technical Committee ISO/TC 3, *Limits and fits*.

This second edition ~~cancels and replaces the first edition~~ (ISO 8062:1984), which has been technically revised.

Annexes A, B and C of this International Standard are for information only.

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Introduction

This International Standard relates to a system of tolerance grades and machining allowance grades for cast metals and their alloys.

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

- a) the proposed casting design and accuracy required;
- b) machining requirements;
- c) method of casting;
- d) the number of castings to be manufactured;
- e) the casting equipment involved;
- f) any special requirements, for instance, datum target systems, individual dimensional tolerances, geometrical tolerances, fillet radii tolerances and individual machining allowances;
- g) whether any other standard is more appropriate for the casting.

NOTE 1 Further investigation on metallic permanent moulds (gravity- and low-pressure), pressure die castings and investment castings should be carried out.

Because the dimensional accuracy of a casting is related to production factors, tolerance grades which can be achieved for various methods and metals are described in annex A for

- a) long series and mass production, where development, adjustment and maintenance of casting equipment make it possible to achieve close tolerances;
- b) short series and single production.

Information on typical required machining allowance grades is given in annex B.

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Castings — System of dimensional tolerances and machining allowances

1 Scope

This International Standard specifies a system of tolerance grades and required machining allowance grades for the dimensions of castings. It is applicable to the dimensions of cast metals and their alloys produced by various casting manufacturing processes [but see also Introduction g) and clause 5].

This International Standard applies both to general tolerances and/or required machining allowances given on a drawing and to individual tolerances and/or required machining allowances which are shown immediately following a specific dimension (see clause 11).

The system specified applies when the foundry provides the pattern or die equipment or accepts responsibility for proving it.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*

ISO 1302:1992, *Technical drawings — Method of indicating surface texture.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 basic dimension: Dimension of a raw casting before machining (see figure 1), the necessary machining allowance being included (see figure 2).

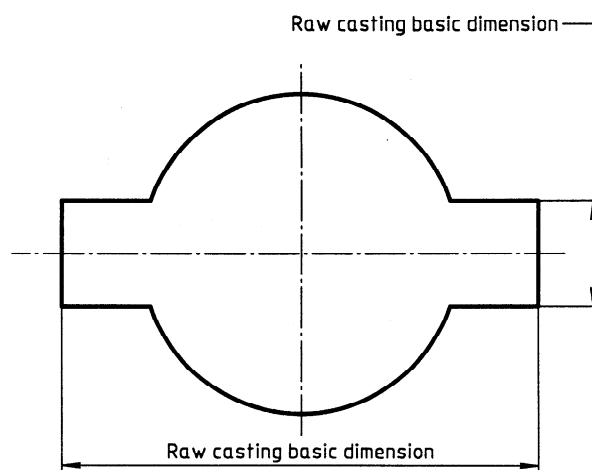


Figure 1 — Drawing indications (see clause 4)

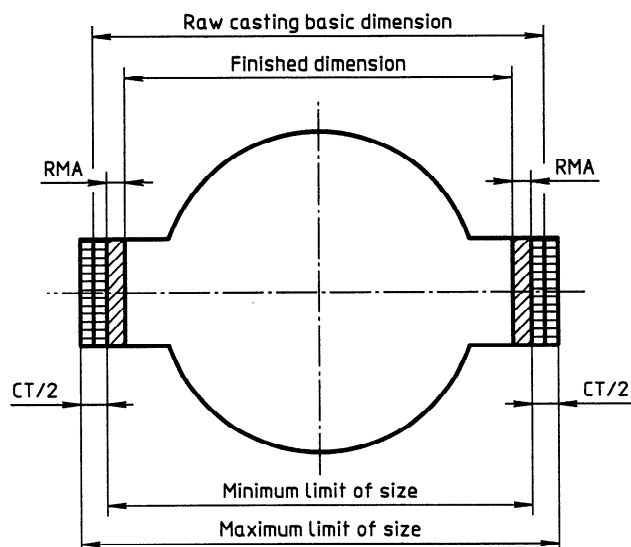


Figure 2 — Tolerance limits

With cylindrical features or machining on both sides, the RMA is taken into account twice (see figures 5 and 6).

3.4 mismatch: Relative displacement of surfaces of a casting owing to inaccuracies in the constituent parts of multipart moulds (see figure 3).

3.5 draft angle (taper): Additional slope of shaping elements (e.g. on enveloping surfaces) necessary to facilitate the removal of a casting from a mould or die, or a pattern from a mould, or the parts of a permanent mould from each other.

4 Dimensioning

With the exception of dimensioning of wall thickness (where a chain of two dimensions may exist), chain dimensioning shall be avoided.

5 Tolerance grades

There are 16 casting tolerance grades, designated CT1 to CT16 (see table 1).

3.2 dimensional tolerance: [See ISO 286-1].

Dimensions for which general tolerances are not suitable shall be allocated individual tolerances.

3.3 required machining allowance, RMA: On raw castings, a material allowance to permit the removal of the effects of casting on the surface by subsequent machining and to allow the achievement of the desired surface texture and the necessary accuracy of dimension.

While work is proceeding to obtain definite tolerance information for metallic permanent mould castings (gravity and low-pressure), pressure die castings and investment castings, other more appropriate tolerance standards, e.g. national standards, may be employed for these particular processes.

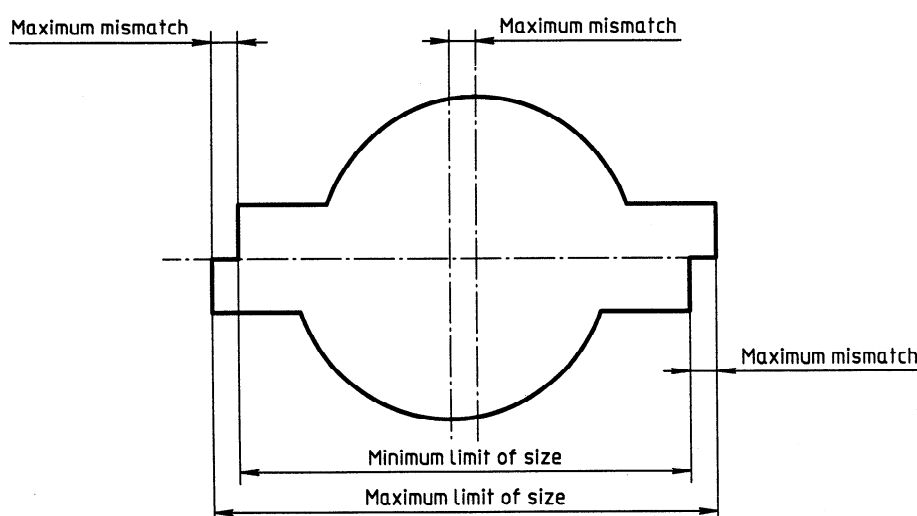


Figure 3 — Maximum mismatch

6 Mismatch

Unless otherwise specified, mismatch shall lie within the tolerance shown in table 1 (see figure 3). When it is important to restrict further the value of mismatch, the maximum value shall be stated on the drawing (see 11.1).

7 Wall thickness

Unless otherwise specified, the tolerance for wall

thickness in grades CT1 to CT15 shall be one grade coarser than the general tolerance for other dimensions; for example, if there is a general tolerance on a drawing of CT10, the tolerance on wall thicknesses shall be CT11.

8 Tapered features

Where a design requires a tapered feature (e.g. feature with a draft angle), the tolerance shall be applied symmetrically along the surface (see figure 4).

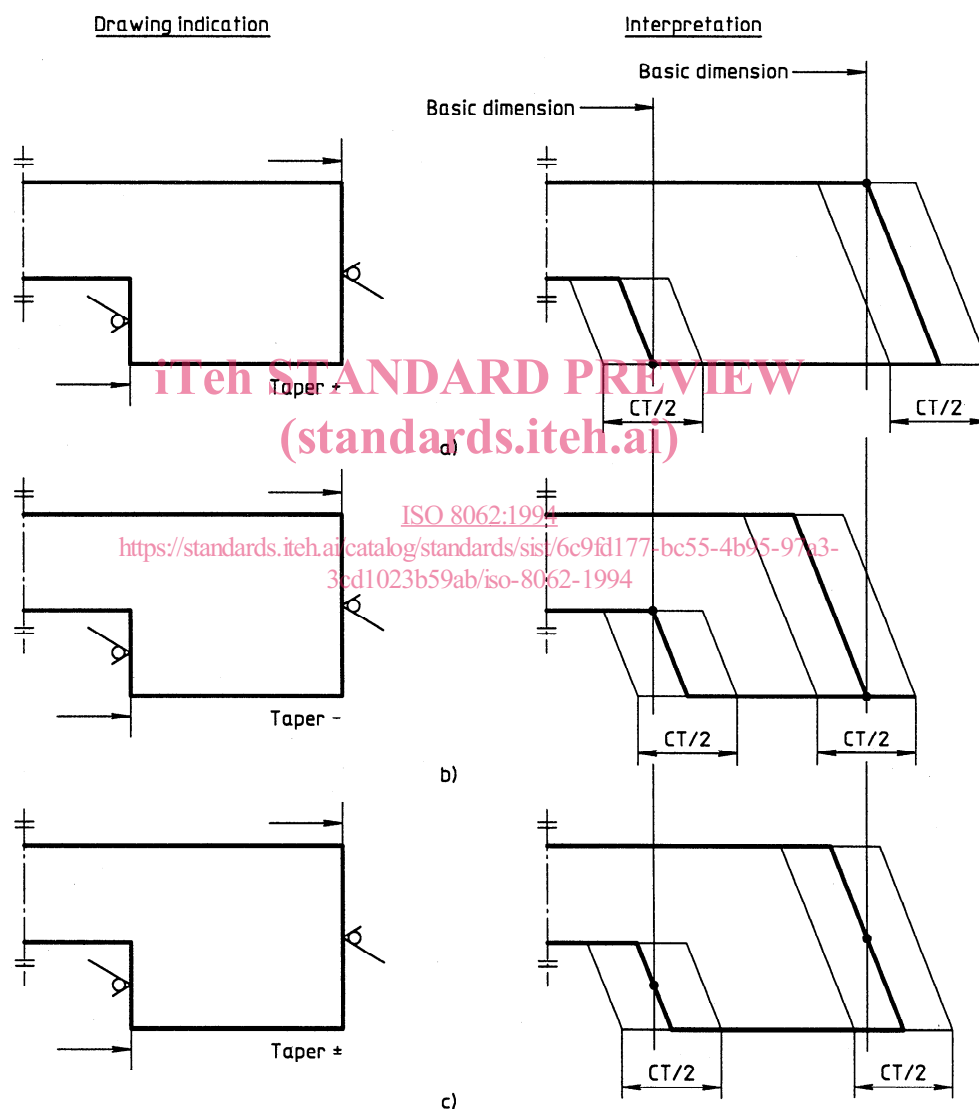


Figure 4 — Tolerance zone on tapered features

The drawing shall specify generally whether the taper shall be added to, subtracted from or averaged to the material, e.g.

taper +, figure 4 a)

taper −, figure 4 b)

taper \pm , figure 4 c)

Tapers for particular surfaces arranged differently from the general arrangement of taper of the drawing shall be indicated individually at the surface, e.g.

+ ✓

For dimensions to be machined, "taper +" shall be applied, irrespective of the general drawing specification for taper, in order that the finished dimensions can be achievable.

9 Position of tolerance zone

The tolerance zone, unless otherwise stated, shall be symmetrically disposed with respect to a basic dimension, i.e. with one half on the positive side and one half on the negative side (see figure 2).

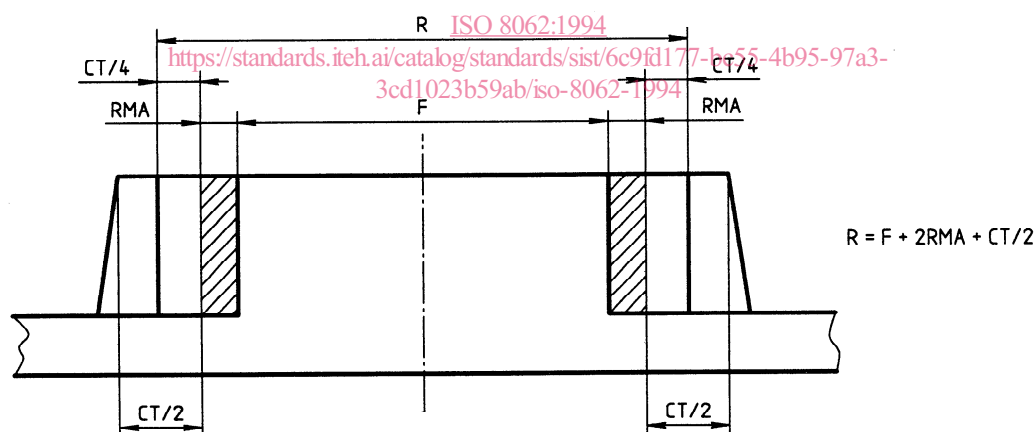
When agreed between manufacturer and purchaser for specific reasons, the tolerance zone may be asymmetric. In such a case the tolerance shall be stated individually, following the basic dimension.

10 Required machining allowances, RMA

10.1 General

Unless otherwise specified, the required machining allowance is valid for the entire raw casting, i.e. only one value is specified for all surfaces to be machined, and this shall be selected from the appropriate dimension range according to the largest overall dimension of the finished casting after final machining (see figure 9).

The maximum dimension of a feature, as cast, shall not exceed the finished dimension plus the required machining allowance plus the total casting tolerance (see figure 2 and figures 5 to 8). When applicable, the taper shall be considered additionally, as shown in figure 4.



R = Raw casting basic dimension

F = Dimension after final machining

RMA = Required machining allowance

CT = Casting tolerance

Figure 5 — External machining of boss

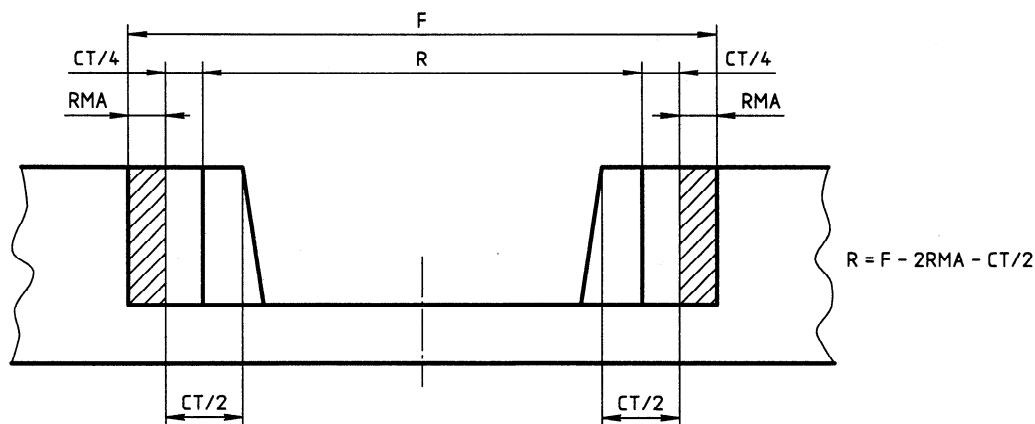


Figure 6 — Internal machining

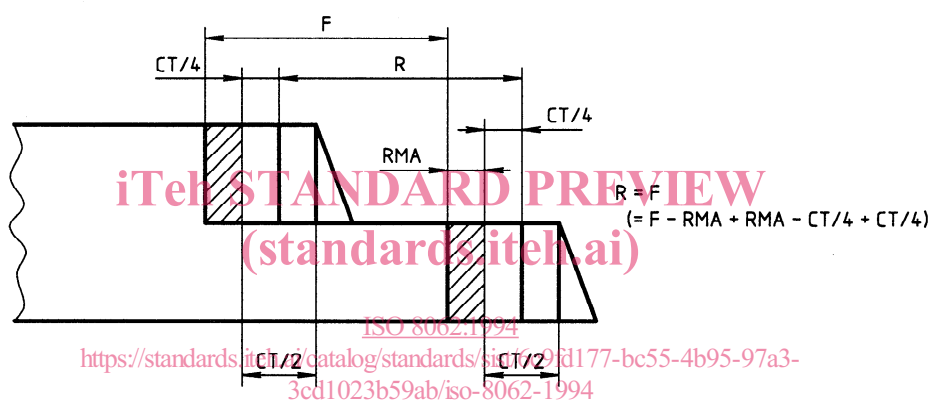


Figure 7 — Machining of step dimension

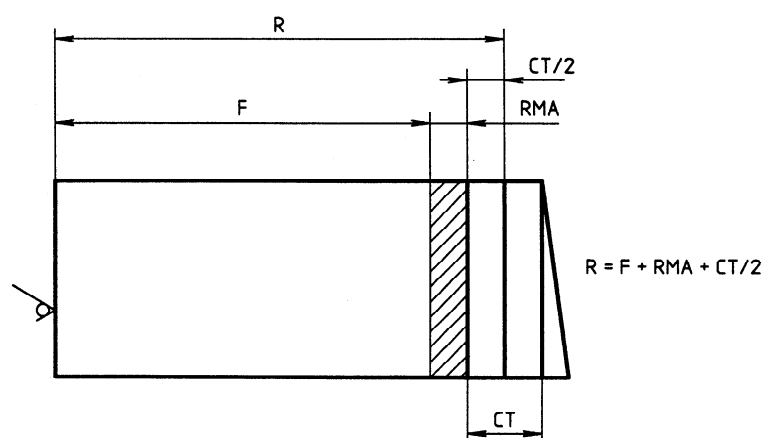


Figure 8 — Machining on one side of feature

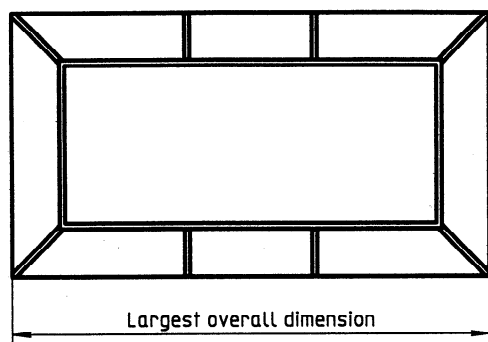


Figure 9 — Largest overall dimension of the casting after final machining

10.2 Grades of required machining allowance

There are 10 grades of required machining allowance, designated A to K (see table 2).

NOTE 2 Grades recommended for particular alloys and manufacturing methods are shown in table B.1 for information only.

10.3 Surfaces pre-machined by the foundry

Any surfaces to be pre-machined by the foundry and the necessary machining allowances for the final machining shall be stipulated on the drawing by the customer in accordance with ISO 1302.

The required machining allowances necessary for the achievement of the pre-machined condition shall be the responsibility of the foundry, independent of the values given in table 2.

11 Indication on drawings

11.1 Indication of casting tolerances

Casting tolerances according to this International Standard shall be stated on the drawing in one of the following ways:

- a) with general information relating to tolerances;

EXAMPLE

"General tolerances ISO 8062 - CT12"

- b) if further restriction of the mismatch is required (see clause 4);

EXAMPLE

"General tolerances ISO 8062 - CT12 - maximum mismatch 1,5"

- c) if individual tolerances are required following the basic dimension.

EXAMPLE

"95 ± 3" or "200 $\begin{smallmatrix} +5 \\ -3 \end{smallmatrix}$ "

11.2 Indication of machining allowances

The surfaces to be machined, the required machining allowance value and, in brackets, the required machining allowance grade shall be stated on the drawing. These shall be taken into account when the pattern or die equipment is being produced.

Required machining allowances shall be stated on the drawing as follows:

- a) with general information relating to tolerances and required machining allowances;

EXAMPLE

For a required machining allowance 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 - CT12):

"ISO 8062 - CT12 - RMA 6 (H)"

and/or

- b) on a particular surface on the drawing, if an individual required machining allowance is necessary (see 10.3).

EXAMPLE

See figure 10.

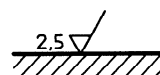


Figure 10 — Indication of required machining allowance on individual surfaces

Table 1 — Casting tolerances

Raw casting basic dimension mm		Total casting tolerance ¹⁾ mm															
		Casting tolerance grade CT ^{2) 3)}															
		1	2	3	4	5	6	7	8	9	10	11	12	13 ⁴⁾	14 ⁴⁾	15 ⁴⁾	16 ⁴⁾⁵⁾
—	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

1) See clause 9.
2) For wall thicknesses in grades CT1 to CT15, one grade coarser applies (see clause 7).
3) See clause 5.
4) For sizes up to 16 mm, general tolerances from CT13 to CT16 are not available. For these sizes individual tolerances shall be indicated.
5) Grade 16 exists only for wall thicknesses of castings generally specified to CT15.