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Geometrical Product Specifications (GPS) — Dimensional and geometrical tolerances for moulded parts

Part 2: Rules

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National foreword

This British Standard is the UK implementation of CEN ISO/TS 8062-2:2013. Together with BS EN ISO 8062-1:2007 and BS EN ISO 8062-3:2007 it supersedes BS 6615:1996 (ISO 8062:1994), which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TDW/4, Technical Product Realization.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

**Geometrical Product Specifications (GPS) - Dimensional and
geometrical tolerances for moulded parts - Part 2: Rules (ISO/TS
8062-2:2013, Corrected version 2013-11-01)**

Spécification géométrique des produits (GPS) - Tolérances
dimensionnelles et géométriques des pièces moulées -
Partie 2: Règles d'utilisation (ISO/TS 8062-2:2013, Version
corrigée 2013-11-01)

Geometrische Produktspezifikationen (GPS) - Maß-, Form-
und Lagetoleranzen für Formteile - Teil 2: Regeln (ISO/TS
8062-2:2013, korrigierte Fassung 2013-11-01)

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Foreword

This document (CEN ISO/TS 8062-2:2013) has been prepared by Technical Committee ISO/TC 213 "Dimensional and geometrical product specifications and verification" in collaboration with Technical Committee CEN/TC 190 "Foundry technology" the secretariat of which is held by DIN.

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Endorsement notice

The text of ISO/TS 8062-2:2013, Corrected version 2013-11-01 has been approved by CEN as CEN ISO/TS 8062-2:2013 without any modification.

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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. www.iso.org/directives

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The committee responsible for this document is ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO 8062 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts*:

- *Part 1: Vocabulary*
- *Part 2: Rules* [Technical Specification]
- *Part 3: General dimensional and geometrical tolerances and machining allowances for castings*

The following part is under preparation:

- *Part 4: General tolerances for castings (according to the GPS rules)*

This corrected version of ISO 8062:2013 incorporates a change in 7.2.2, Figure 8.

Introduction

This part of ISO 8062 is to be regarded as a complementary process-specific tolerance geometrical production specification (GPS) standard (see ISO/TR 14638). It influences chain links 1, 2 and 3 of the chain of standards on mouldings.

The ISO/GPS Masterplan given in ISO/TR 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise indicated.

For more detailed information about the relation of this part of ISO 8062 to other standards and the GPS matrix model, see [Annex F](#).

This part of ISO 8062 takes into account experiences with the application of previous standards (e.g. ISO 8062:1994, ASME Y14-8M:1996, and ISO 1101).

The tolerancing methods in this part of ISO 8062 are not yet fully developed within the new approach of geometrical product specifications (GPS) according to ISO 17450. The requirements for castings (mainly due to the uncertainty in the calculation of the shrinking of the casting) remain incompatible with the GPS standards. Therefore, this Technical Specification has been issued in order to gather further experience in the tolerancing of castings.

It is intended that the next version of this document will include more realistic ways of calculating the nominal dimension d_C of the final moulded part by elaborating GPS-conformant ways of combining linear dimensions and tolerance zones.

This document is intended to cover all types of moulded parts. However, most of the examples refer to castings.

When the methods of this part of ISO 8062 are used in 3D models, provisions have to be made in order to distinguish between theoretically exact dimensions (TEDs) and linear and angular dimensions with plus/minus tolerances.

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

Part 2: Rules

1 Scope

This part of ISO 8062 gives the rules for geometrical dimensioning and tolerancing of final moulded parts and parts machined out of moulded parts. It also gives rules and conventions for the indications of these requirements in technical product documentation and specifies the proportions and dimensions of the graphical symbols to be used.

This part of ISO 8062 provides symbols which may be used to identify the relative completeness of the moulded features and parts. These graphical symbols should not be confused with the graphical symbols for surface texture according to ISO 1302, which are notably larger.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 drawings — Indication 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, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 2692, *Geometrical product specifications (GPS) — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)*

ISO 5458, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Positional tolerancing*

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

ISO 7083, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*

ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

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

ISO 8062-3:2007, *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 3: General dimensional and geometrical tolerances and machining allowances for castings*

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*

ISO 13715, *Technical drawings — Edges of undefined shape — Vocabulary and indications*

ISO 14405-2, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 2: Dimensions other than linear sizes*

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

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 terms and definitions given in ISO 8062-1, ISO 1101, ISO 5459, ISO 17450-1 and the following apply.

3.1 moulded feature

<of a moulded part> feature which has not been machined on a moulded part

3.2 intermediate machined feature

<of a moulded part> feature of a moulded part which has undergone machining and which subsequently will be machined to its final condition

Note 1 to entry: An intermediate machined feature is typically a roughly machined *moulded feature* (3.1).

Note 2 to entry: An intermediate machined feature can be used as a datum for subsequent machining of the moulded part.

3.3 final machined feature

<of a moulded part> feature of a moulded part which has been machined to its final condition

3.4 final moulded part

moulded part after fettling (if any)

Note 1 to entry: A final moulded part only consists of features which are moulded and have not been finished except by fettling.

3.5 intermediate machined moulded part

moulded part which has undergone some machining and which subsequently will be machined further

Note 1 to entry: An intermediate machined moulded part consists of at least one *moulded feature* (3.1) to be subsequently machined or at least one *intermediate machined feature* (3.2). In addition, it consists of moulded features not to be machined (if any) and *final machined features* (3.3) (if any).

Note 2 to entry: An intermediate machined moulded part can be produced from a final moulded part or from another intermediate machined moulded part.

3.6 final machined moulded part

moulded part which has been machined to its final condition

Note 1 to entry: A final machined moulded part consists of *final machined features* (3.3) and can include *moulded features* (3.1) not to be machined. A final machined moulded part cannot include *intermediate machined moulded features*.

Note 2 to entry: A final machined moulded part can be produced from a *final moulded part* (3.4) or from an *intermediate machined moulded part* (3.5).

3.7

moulded-part condition

manufacturing stage of a moulded part

Note 1 to entry: Listed in chronological order of manufacturing, a moulded part can be in a *final moulded-part* (3.4) condition, *intermediate machined moulded-part* (3.5) condition or *final machined moulded-part* (3.6) condition.

Note 2 to entry: Only one final moulded-part condition exists.

Note 3 to entry: Various intermediate machined moulded-part conditions can exist.

Note 4 to entry: Only one final machined moulded-part condition can exist.

Note 5 to entry: A moulded part does not need to exist in an intermediate machined moulded-part condition before the final machined moulded-part condition.

Note 6 to entry: Heat treatment or straightening (correction of unintended distortion) can be carried out in any moulded-part condition.

3.8

single drawing

<of a moulded part> drawing of a moulded part giving requirements for one moulded-part condition only

3.9

combined drawing

<of a moulded part> drawing of a moulded part giving requirements for more than one moulded-part condition

4 Symbols

See [Table 1](#) for the letter symbols and [Table 2](#) for the graphical symbols used in this document.

Table 1 — Letter symbols

Term, quantity	Letter symbol
Required machining allowance	A_{RMA}
Nominal dimension of the final moulded part	d_{C}
Nominal dimension of the final machined moulded part	d_{M}
Dimensional or size tolerance	t_{D}
Machining tolerance	t_{M}
Dimensional tolerance for the final machined moulded part	t_{DMT}
Form tolerance	t_{F}
Form tolerance for the final machined moulded part	t_{FMT}
Form tolerance for the final moulded part	t_{FCT}
Specific form tolerance of geometrical casting tolerance (GCT) for the final moulded part (casting)	
Casting form tolerance	
Dimensional tolerance for the final moulded part (casting)	t_{DCT}
Geometrical tolerance for the final moulded part (casting)	t_{GCT}
Cutting depth for machining	c
Parallelism tolerance for the final moulded part (casting)	t_{PARC}
Flatness tolerance for the final moulded part (casting)	t_{FLAC}
Casting tolerance	t_{C}
Positional tolerance	t_{POS}
Orientation contribution value	c_{inclin}
Length of datum	l_{d}
Length of toleranced feature	l_{t}
Surface profile tolerance	t_{PROF}
Maximum material virtual size	S_{MMVS}
Least material virtual size	S_{LMVS}
Theoretical exact dimension	TED

Table 2 — Graphical symbols

Name of symbol	Graphical symbol	Clause	Reference document
Drawing identifier for final moulded part		6.2	ISO/TS 8062-2
Drawing identifier for intermediate machined moulded part		6.3	ISO/TS 8062-2
Drawing identifier for final machined moulded part		6.4	ISO/TS 8062-2
Identifier for machining by the supplier ^a		6.5	ISO/TS 8062-2
Part condition identifier for final moulded part		7.2	ISO/TS 8062-2
Part condition identifier for intermediate machined moulded part		7.2	ISO/TS 8062-2
Part condition identifier for final machined moulded part		7.2	ISO/TS 8062-2
Surface texture — removal of material not permitted		7.1.2	ISO 1302
Surface texture — removal of material required		7.1.3	ISO 1302
^a When there is a change in the allocation of the supplier, a change of the documentation may be necessary to reflect this.			

See [Annex A](#) for the proportions and dimensions of the graphical symbols referenced in this part of ISO 8062.

5 Designation on drawings

When drawing indications according to this part of ISO 8062 apply, the drawing shall be designated in or near the drawing title block:

ISO/TS 8062-2

However, this reference is not required if general tolerances or required machining allowances according to other parts of ISO 8062 are referenced.

6 Drawing type indicator

6.1 Single and combined drawings

The requirements for the three types of moulded-part conditions (final moulded, intermediate and final machined) can be specified on a combined drawing or separately on single drawings as appropriate.

If use of the symbology in this document makes a combined drawing difficult to read, use single drawings instead.

Information, as to which part condition or conditions the stated specifications on the drawing apply, shall be indicated on the drawing in accordance with the following clauses; therefore the drawing shall indicate which part condition(s) the stated specification applies to.

On combined drawings, only the outline of the most advanced part condition for which the drawing is valid shall be illustrated. Requirements for the most advanced condition and for the preceding moulded-part condition in question shall be stated.

6.2 Final moulded part drawings

If the drawing specifies requirements on a final moulded part, the graphical symbol given in [Figure 1](#) shall be indicated in or near the drawing title block.



Figure 1 — Graphical symbol for a final moulded part drawing

6.3 Intermediate machined moulded part drawings

If the drawing specifies requirements on an intermediate machined moulded part, the graphical symbol given in [Figure 2](#) shall be indicated in or near the drawing title block.



Figure 2 — Graphical symbol for an intermediate machined moulded part drawing

If more than one intermediate machined moulded-part condition exist on the drawing, they shall be numbered and indicated after the symbol (see [Figure 3](#)).



a)



b)



c)

Figure 3 — Examples of numbered intermediate machined moulded parts

If stating general tolerances on a single drawing of an intermediate machined moulded part, e.g. by referencing ISO 8062-3 or by stating particular general tolerances, these general tolerances apply to the moulded features in the intermediate machined moulded-part condition only.

6.4 Final machined moulded part drawings

If the drawing states requirements on a final machined moulded part, the graphical symbol given in [Figure 4](#) shall be indicated in or near the title block.



Figure 4 — Graphical symbol for final machined moulded part drawing

If stating general tolerances according to ISO 8062, e.g. by referencing ISO 8062-3 for castings, on a drawing of a final machined moulded part, these general tolerances apply to the moulded surfaces in the final machined moulded-part condition only.

6.5 Identifier for machining by the supplier

If there is, for some special reason, a need to identify which part condition specifications a supplier is expected to meet, this can be indicated by the symbol as shown in [Figure 5](#) after the drawing type indicator (see [Figure 6](#)).



Figure 5 — Symbol for machining by the supplier

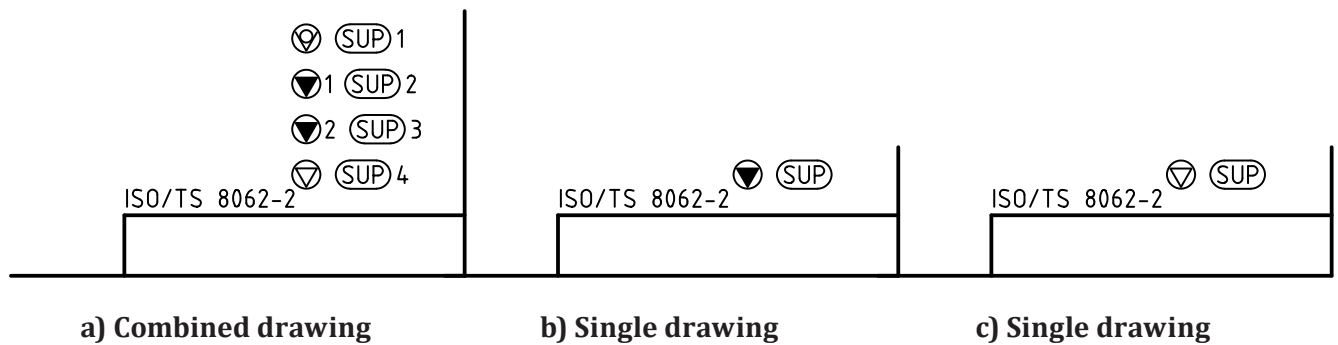


Figure 6 — Example of SUP indication used together with the drawing type indicator near the drawing title block

In any case, the contract shall clearly state which part condition and which specification the supplier is expected to meet, irrespective of other part conditions and specifications appearing on the drawing.

7 Drawing indications

7.1 Surface texture symbols

On combined drawings, each surface shall be indicated with only one surface texture symbol according to the condition of the surface in question on the most advanced part condition stated on the drawing.

7.2 Part condition identifiers

7.2.1 General

Three part condition identifiers are used for identifying which part condition a specification applies to (see [Figure 7](#)).



Figure 7 — Part condition identifiers

The part condition identifier may be omitted on single drawings.

The use of part condition identifiers is necessary on combined drawing to state requirements to different part conditions (final moulded, intermediate machined moulded, final machined moulded), see [Figure E.7](#). More than one intermediate machined moulded-part condition may be specified. This being the case, the intermediate machined moulded-part condition is enumerated in consecutive sequence according to the manufacturing processes.

When a specification is given without a part condition identifier, this specification applies to all part conditions stated on the drawing.

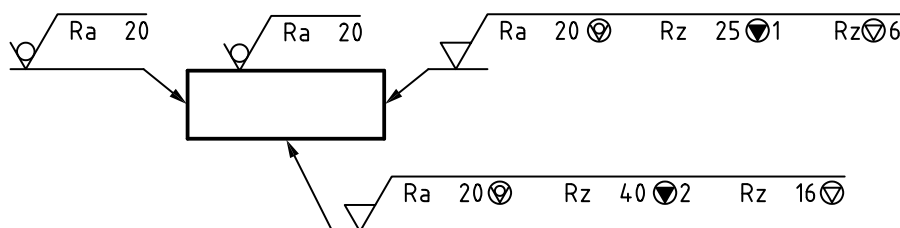
On combined drawings, requirements on features that remain as moulded in the most advanced part condition according to the drawing may also be given. If not otherwise specified, this type of specification applies to all part conditions according to the drawing, see [Figure 8](#).

When a specification is given with an intermediate part condition, this specification applies for all subsequent part conditions if not otherwise specified.

7.2.2 Surface texture

On combined drawings, surface texture requirements shall be indicated for each part condition using the symbols as shown in [Figure 8](#).

Drawing indication:



Meaning

condition

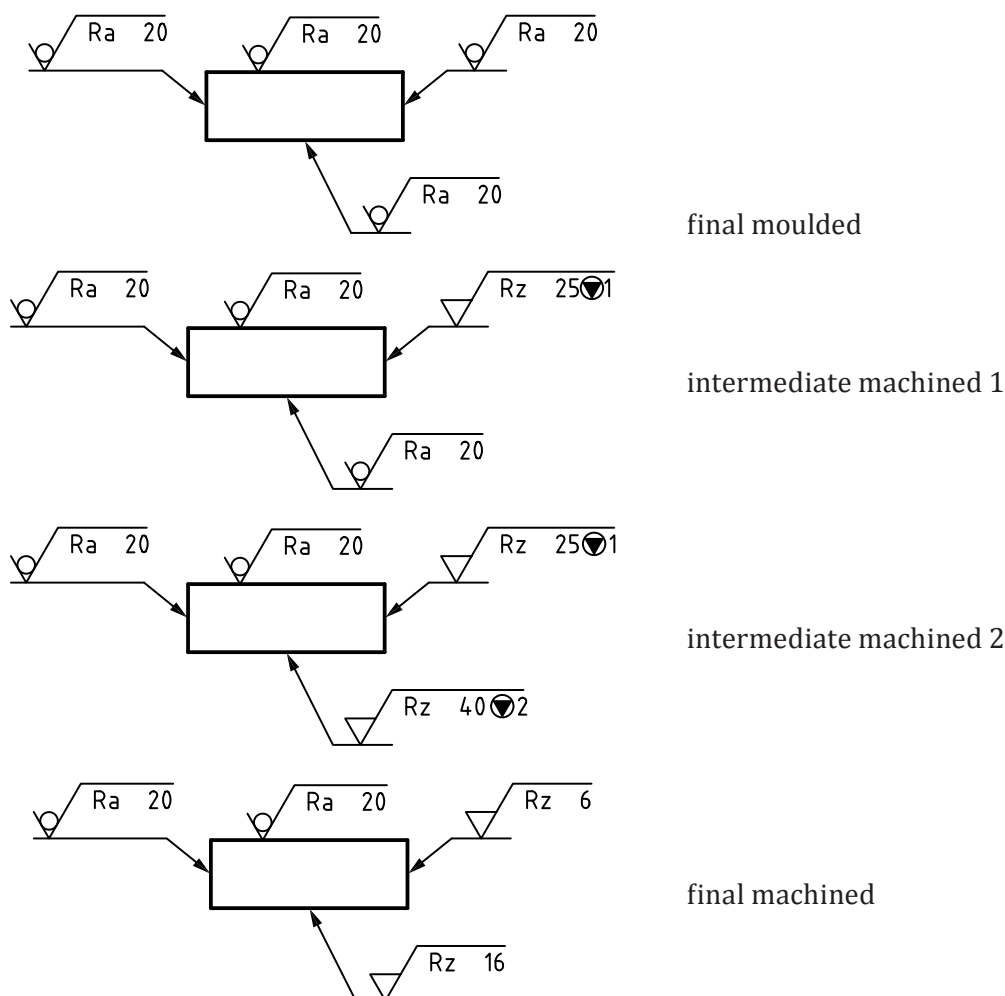


Figure 8 — Example of a surface texture indication on a combined drawing and its interpretation

7.2.3 Linear dimensions

The part condition to which the linear dimension applies shall be indicated by a part condition identifier as shown in [Figure 9](#), if necessary.

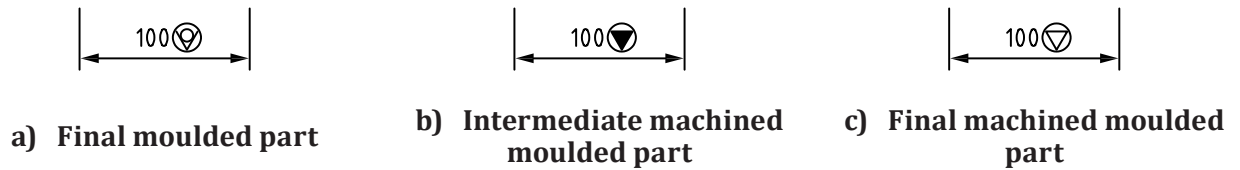


Figure 9 — Examples of nominal dimensions

7.2.4 Linear dimensions and individually indicated dimensional tolerances

The part condition to which the linear dimension with its tolerance applies shall be indicated by a part condition identifier as shown in [Figure 10](#), if necessary.

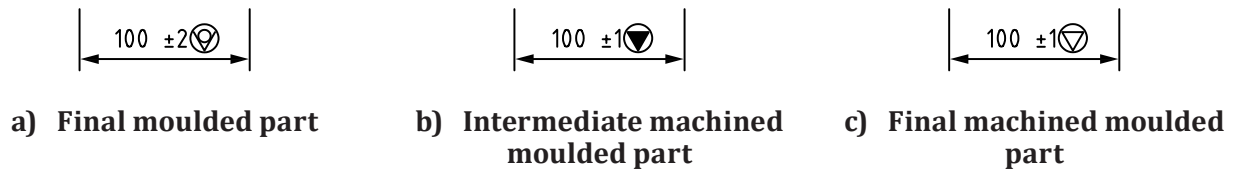


Figure 10 — Examples of nominal dimensions with individual tolerances

7.2.5 Theoretically exact dimensions

The part condition to which the theoretically exact dimension applies shall be indicated by a part condition identifier as shown in [Figure 11](#), if necessary.

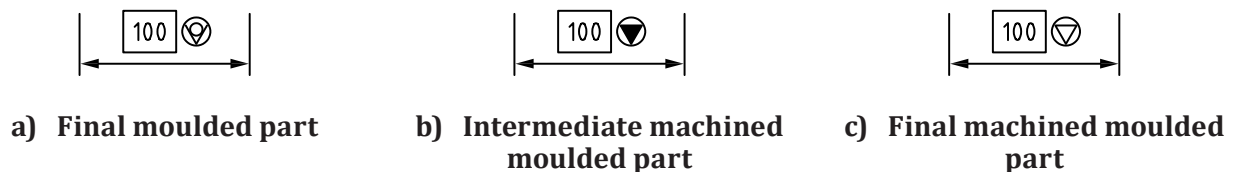


Figure 11 — Examples of theoretically exact dimensions

7.2.6 Geometrical tolerances and datums

The part condition to which the geometrical tolerance applies, shall be indicated by a part condition identifier as shown in [Figure 12](#), if necessary.



Figure 12 — Examples of geometrical tolerances with datum references

The part condition identifier shall be indicated after the tolerance frame. If the datum exists in different part conditions than those specified by the surface texture symbol, the datum applies in that part condition stated together with the tolerance value (see [Figures 13](#) and [14](#)).

If the datum is specified to a planar feature in the final moulded-part condition and the feature has a taper, the datum applies without the taper, i.e. the actual taper shall be removed mechanically or virtually. If possible, planar surfaces with tapers should not be used as datums.

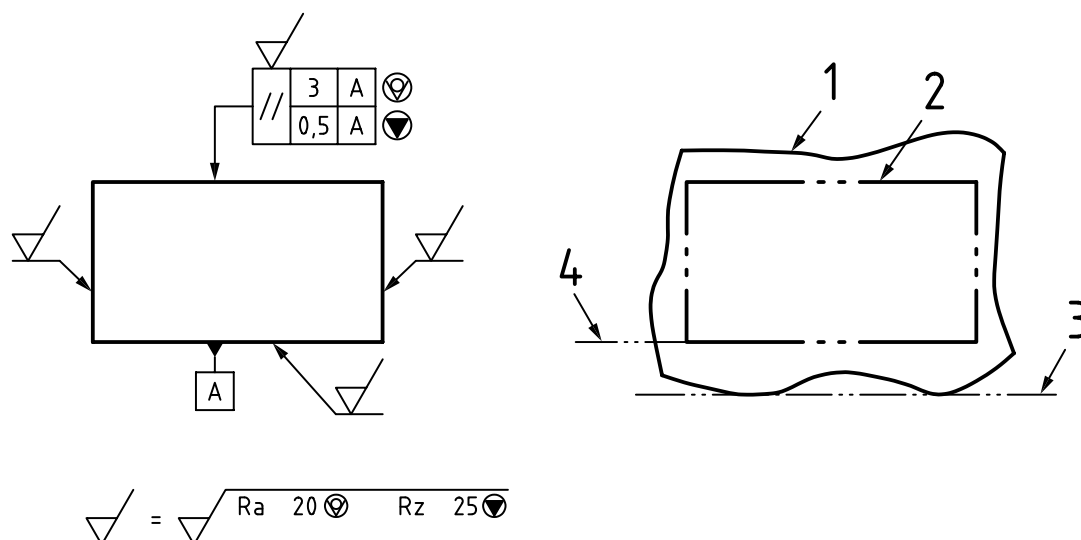
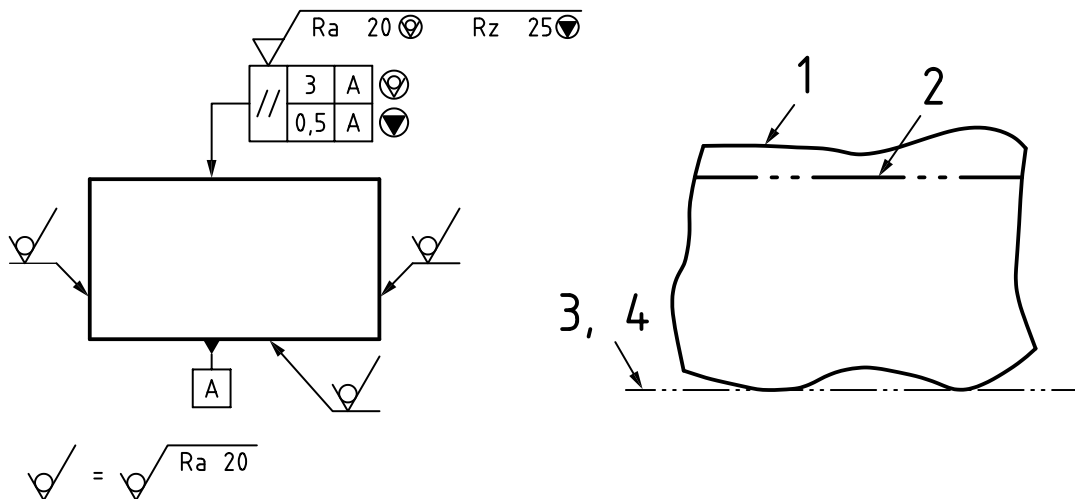


Figure 13 — Example of a datum indication in different part conditions with different datums



Key

- | | |
|--------------------------------------|---|
| 1 final moulded part | 3 datum A of final moulded part |
| 2 intermediate machined moulded part | 4 datum A of intermediate machined moulded part |

Figure 14 — Example of a datum indication in different part conditions with same datum

When a geometrical tolerance specification is given without a part condition identifier, this specification applies to all part conditions stated on the drawing.

7.3 Required machining allowance, RMA

7.3.1 General

All required machining allowance values, A_{RMA} , are nominal values, and have no tolerance.

7.3.2 General required machining allowance

If a general required machining allowance is to apply to all surfaces to be machined on the final moulded part, it shall be stated in or near the drawing title block according to ISO 8062-3, e.g.

General tolerances ISO 8062-3 RMA 6 (RMAG H)

Only one value is specified for all surfaces to be machined, and this value shall be selected from the appropriate dimension range according to the largest overall dimension of the final moulded part. ISO 8062-3 contains standardized required machining allowances.

7.3.3 Individual required machining allowance

If a special required machining allowance is to apply to an individual surface, it shall be indicated individually before the surface texture symbol according to ISO 1302 (see [Figure 15](#)).

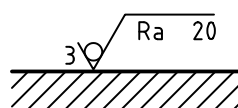


Figure 15 — Individual required machining allowance

An individual required machining allowance overrules a general required machining allowance.

In sand casting, top surfaces sometimes need more machining allowance than other features. For these surfaces, coarser required-machining-allowance grades can be selected and then indicated individually.

8 Indication of general tolerances

8.1 General tolerances according to ISO 8062-3

On drawings, the callout of general tolerances, e.g. according to ISO 8062-3, applies only to those part conditions stated by the drawing type indicator.

On combined drawings where the drawing type indicator for final moulded is stated and the general tolerance according to ISO 8062-3 is referenced, all non-individually indicated dimensions on the final moulded-part condition are to be calculated according to the accumulation method, see [Annex B](#).

General tolerances for moulded parts shall be indicated in or near the drawing title block, if applicable. See [Figures E.3](#), [E.4](#), [E.5](#).

8.2 General surface profile tolerance

See [Figure 16](#).

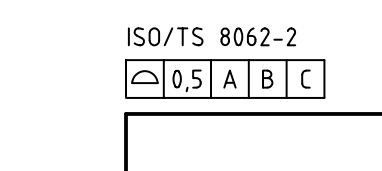


Figure 16 — Example of the indication of general surface profile tolerance

The general surface profile tolerance applies to all surfaces which are not explicitly dimensioned with linear and angular dimensions with plus/minus tolerance.

The geometry of all the surfaces to which the general surface profile tolerance applies shall be specified with the theoretically exact dimension (TED) in its entirety, and shall be considered as a single pattern.

NOTE When using a general surface profile tolerance for the final moulded part, the reference to the general tolerances according to ISO 8062-3 for the same part condition cannot be used because of a contradiction.

9 Types of specifications

9.1 General

The geometry of the part in its different conditions shall be specified completely. This can be done by using the following specification methods.

9.2 Specification of final moulded-part condition

9.2.1 The final moulded-part condition can be specified directly on a single final moulded part drawing according to ISO 10135. This method shall be used if the final moulded part is not to be machined.

If the final moulded part is to be machined, the specification of the final moulded part can be given on a combined drawing

- indirectly, by using the accumulation method, or
- directly, by using the multiple tolerancing method.

9.2.2 When using the accumulation method, the final moulded part is specified indirectly on the drawing in the following way:

- the machined moulded part is specified directly in total;
- appropriate dimensional tolerance grade (DCTG) according to ISO 8062-3 is specified;
- appropriate geometrical tolerance grade (GCTG) according to ISO 8062-3 is specified;
- appropriate required machining allowance grade (RMAG) according to ISO 8062-3 is specified;
- drawing type indicator for final moulded part is indicated;
- drawing type indicator for final machined moulded part is indicated.

As a result, the drawing is a combined drawing indirectly giving the specifications on the final moulded part. In this case, unless otherwise specified, the linear dimensions, which are not individually indicated on the final moulded part drawing, are to be calculated. The dimensional and the geometrical tolerances which are not individually indicated on the final moulded part drawing are given by ISO 8062-3.

This specification method can lead to large excess material, but simplifies the specification of the final moulded part.

9.2.3 When using the multiple tolerancing method, the final moulded part is specified directly on the drawing in the following way:

- the most advanced machined moulded part, illustrated on the drawing, is specified in total;
- the final moulded part is specified directly in total;
- drawing type indicator for final moulded part is stated.

The specification of the final moulded part and the machined moulded parts should mainly be done by using appropriate geometrical tolerances according to ISO 1101. For sizes (e.g. diameters, widths of slots, tabs), wall thicknesses, fillets and chamfers, dimensional tolerancing (+/- tolerancing) may be used instead.

9.2.4 The tolerances according to ISO 1101 may be specified as general tolerances (with or without individual tolerances) or as individual tolerances only.

ISO 8062-3 may be used as a guidance to select appropriate individual tolerance values.

This specification method can lead to smaller excess material than the accumulation method, but needs complete specification of the final moulded part directly on the drawing.

9.2.5 Surface profile (profile of any surface) tolerances may be used

- either for all surfaces, or
- for all surfaces except those belonging to features of size (diameters and widths), fillets and chamfers. Features of size may be toleranced by dimensional tolerances together with positional tolerances and, if appropriate, with maximum material requirement $\textcircled{M}$ or least material requirement $\textcircled{L}$ (see ISO 2692). Fillets and chamfers may be toleranced with linear dimensions.

9.3 Specification of intermediate machined moulded-part conditions

The specification of the intermediate machined moulded part can be given on a single drawing of the intermediate machined moulded part only or on a combined drawing which includes this intermediate machined moulded part and the final moulded-part condition or other intermediate moulded parts or the final machined moulded-part condition.