CONTENT

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1 Purpose

This company standard provides an overview of the standards to be used for general tolerances. It specifies which standard shall be used for which components and defines tolerance classes in addition to ISO 22081.

2 Scope

This Company Standard shall be applied in the development of constructions and their technical product documentation within the ETO GRUPPE.

This document shall be applied as of 2024-09-01. Until then its application is possible but not required.

3 Change History

2024-03 First edition

4 Applicable Documents

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. In the case of dated references, only the edition referred to applies. In the case of undated references, the latest edition of the referenced document (including all amendments) shall apply.

ISO 14405-1	Geometrical product specifications (GPS) – Dimensional tolerancing – Part 1: Linear sizes
ISO 14405-3	Geometrical product specifications (GPS) – Dimensional tolerancing – Part 3: Angular sizes
ISO 1101	Geometrical product specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out
ISO 5459	Geometrical product specifications (GPS) – Geometrical tolerancing – Datums and datum systems
ISO 22081:2021-02	Geometrical product specifications (GPS) – Geometrical tolerancing – General geometrical specifications and general size specifications
ISO 20457:2018-09	Plastics moulded parts – Tolerances and acceptance conditions
ISO 3302-1:2014-07	Rubber – Tolerances for products – Part 1: Dimensional tolerances
DIN 6930-2:2011-10	Stanzteile aus Stahl – Teil 2: Allgemeintoleranzen English translation: Stamped steel parts – Part 2: General tolerances

5 Definition of Terms and Abbreviations

For the purposes of this document the terms according to ISO 14405-1, ISO 14405-3, ISO 1101, ISO 5459, ISO 22081 and the following terms apply.

TPD - Technical Product Documentation
All information, documents and files which describe the nominal geometry of a product (component, assembly or finished product). This can be drawings, bills of material or 3D models, for example.

6 Basic Principles

6.1 General

The standards for general tolerances covered in this document define concepts for the tolerancing of features which no individual tolerances are indicated for in the TPD.

If one of these standards applies to specific products or processes, that standard shall be applied to that scope of application only.

This company standard does not represent a complete list of all standards for general tolerances. If the application of a standard for general tolerances which is not covered here is appropriate, that standard can also be applied.

6.2 Basic rules

- The tolerance classes shall be specified for each component individually depending on the process and material.
- Functionally relevant features shall be toleranced directly.
- The TPD should describe a construction completely and unambiguously.
- In case of changes on existing constructions with the indication of a withdrawn standard for general tolerances,
  - it shall be amended with the date of the respective edition of the standard, or
  - the construction shall be modified to match a valid standard for general tolerances.

7 General tolerance according to ISO 22081

7.1 General

ISO 22081 defines a system for general tolerances without specifying explicit tolerance values. The system is not restricted to specific manufacturing processes and can therefore be applied to the TPD of all products.

Tolerance values and tolerance classes are defined in the chapters 7.2 to 7.4. The indication in drawings is defined in chapter 7.5.

For the application of this standard the rules A to H of the standard ISO 22081:2021-02 shall be complied with.

7.2 Surface profile

The indication of a general surface profile tolerance may be given in the TPD of a product, if

- the product includes many complex features, and
- these features can be described with individual dimensions and tolerances only with difficulty, and
- these features are not functionally relevant, and
- relatively large tolerances are possible on these features.

In addition to the general surface profile tolerance the following text shall be entered in proximity to the general surface profile tolerance:

VERIFICATION OF GENERAL SURFACE PROFILE TOLERANCE MUST BE AGREED SEPARATELY

DIE VERIFIKATION DER ALLGEMEINEN FLAECHENPROFILTOLERANZ MUSS GESONDERT VEREINBART WERDEN

The legally binding language in the TPD is always English. Other languages are for information only.

An overview of the possible application of the general surface profile tolerance is presented in Table 1. This table does not claim to be complete. Exceptions from the table shall be coordinated with the responsible quality department.

Table 1 Overview for the indication of general surface profile tolerances

Product type	**General surface profile tolerance permitted**
Turned parts	no
Milled parts	no
Stamped-bent parts	no
Customer drawings and finished products	no
Cast parts	yes
Plastics moulded parts	yes
Sintered parts	yes

For the indication of the general surface profile tolerance the tolerance value shall directly be entered in a tolerance frame. Table 2 can provide orientation, which tolerance value is appropriate for the respective product.

For the selection of the tolerance the influences (e.g. material and manufacturing process) shall always be taken into account. The tolerance shall be selected as coarse as possible and as fine as required.

Table 2 General tolerance values for surface profiles

Sizes in millimeters

	Diameter of the smallest circumscribed sphere of the part[a]							
above	0	3	6	30	120	400	1000	2000
up to and including	3	6	30	120	400	1000	2000	4000
	Tolerance values							
fine	0.1	0.1	0.2	0.3	0.4	0.6	1.0	2.0
medium	0.2	0.2	0.4	0.6	1.0	1.6	2.4	4.0
	0.4	0.6	1.0	1.6	2.4	4.0	6.0	8.0
coarse	0.6	1.0	2.0	3.0	5.0	8.0	12.0	16.0
[a] see Annex A								

7.3 Linear sizes

General tolerance values for linear sizes are defined in the tolerance classes a to d (see Table 3).

These values only apply to linear sizes such as the diameter of cylinders or the distance between two parallel opposite planes, details see ISO 14405-1.

They do not apply to linear distances, radii, chamfers and derived features, such as median planes, median lines or median points, see ISO 14405-2.

Table 3 General tolerance values for linear sizes

Sizes in millimeters

	Nominal size range							
above	0	3	6	30	120	400	1000	2000
up to and including	3	6	30	120	400	1000	2000	4000
Tolerance class	**Tolerance values**							
a	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5	±1.0
b	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2.0
c	±0.2	±0.3	±0.5	±0.8	±1.2	±2.0	±3.0	±4.0
d	±0.3	±0.5	±1.0	±1.5	±2.5	±4.0	±6.0	±8.0

7.4 Angular sizes

General tolerance values for angular sizes are defined in the tolerance classes 1 to 3 (see Table 4).

These values only apply to angular sizes such as on cones or wedges, Details see ISO 14405-3.

They do not apply to angular distances and derived features such as median planes, median lines or median points, see ISO 14405-2.

Table 4 General tolerance values for angular sizes

	Length of the shorter angle side in millimeters				
above	0	10	50	120	400
up to and including	10	50	120	400	—
Tolerance class	**Tolerance values in degrees and minutes**				
1	±1°	±0°30′	±0°20′	±0°10′	±0°5′
2	±1°30′	±1°	±0°30′	±0°15′	±0°10′
3	±3°	±2°	±1°	±0°30′	±0°20′

7.5 Wall thickness

Moulded parts often include thin walled features such as reinforcing ribs. The wall thickness of these features shall not be subject to the general surface profile tolerance, as otherwise there is a risk, that the wall thickness will be too thin.

Therefore an indication of the general tolerance of wall thickness shall be given on drawings of moulded parts. This indication shall be independent from the nominal size and it shall be defined as a spherical size, see example in Image 1.

The general tolerance of wall thickness does not apply to individually toleranced wall thicknesses.

Image 1 Example of a general wall thickness tolerance

7.6 Drawing indication

The indication of the general tolerance according to ISO 22081 shall be given in or in proximity to the title block according to the following rules, see examples in Image 2, Image 3 and Image 4.

- Formulation „General tolerances“, followed by the reference to the standard ISO 22081:2021-02 and this company standard ETN042:2024-03, and
- formulation „Linear sizes:“, followed by the reference to Table 3 in this document and one of the tolerance classes, and/or

- formulation „Angular sizes:“, followed by the reference to Table 4 in this document and one of the tolerance classes, and/or
- indication of a general surface profile tolerance in combination with the reference to the verification subject to agreement.

Image 2 example ISO 22081 with general surface profile tolerance only

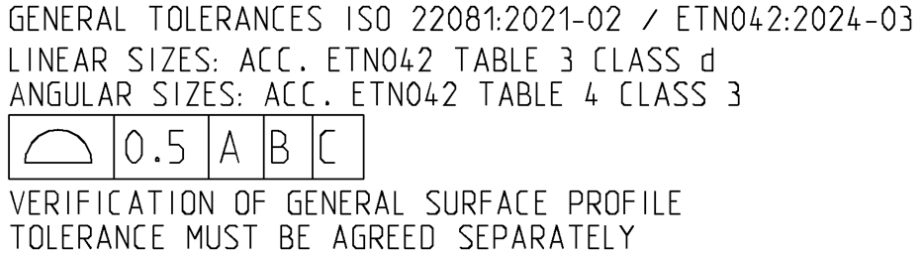

Image 3 example ISO 22081 with complete indication

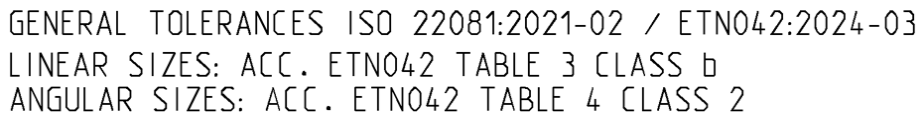

Image 4 example ISO 22081 with general size tolerances only

8 General tolerance for plastics moulded parts according to ISO 20457

8.1 General

The standard ISO 20457 specifies possible manufacturing tolerances for plastics moulded parts. It defines tolerance grades which provide orientation for the tolerance definition and can be used as a general tolerance for linear sizes. The tolerance grade shall be calculated according to ISO 20457:2018-09, chapter 7.1.2.

Before the application of this standard especially chapter 5 of ISO 20457:2018-09 must be taken into account.

8.2 Linear sizes

The calculated tolerance grade, in combination with Table 2 of ISO 20457:2018-09, can be applied to general tolerances for linear sizes. These apply to nominal sizes explicitly indicated in the drawing only.

Furthermore, Table 2 of ISO 20457:2018-09 provides orientation, which tolerances are appropriate from a manufacturing point of view.

8.3 Position tolerances

The calculated tolerance grade, in combination with Table 9 of ISO 20457:2018-09 provides orientation, which position tolerances are appropriate from a manufacturing point of view.

The application of the general position tolerance according to ISO 20457 is explicitly not allowed. Each position tolerance shall be indicated individually.

8.4 Surface profile tolerances

Table 10 of ISO 20457:2018-09 provides orientation, which surface profile tolerances are appropriate from a manufacturing point of view. For this the nominal dimension Dp, is determining, meaning the furthest distance of the toleranced element to the origin of the datum system used for the tolerance.

The application of the general surface profile tolerance according to ISO 20457 is explicitly not allowed. A general surface profile tolerance according to ISO 22081 and the rules from chapter 7 of this company standard can be indicated.

8.5 Drawing indication

The indication of the general tolerance according to ISO 20457 shall be given in or in proximity to the title block according to the following rules, see examples in Image 5 and Image 6.

- Formulation „General tolerances“, followed by the reference to the standard ISO 20457:YYYY-MM,
- followed by a hyphen,
- followed by the tolerance grade,
- additionally a general surface profile tolerance according to ISO 22081 and the rules from chapter 7 of this company standard can be indicated.

Image 5 Example ISO 20457 with tolerance grade TG6

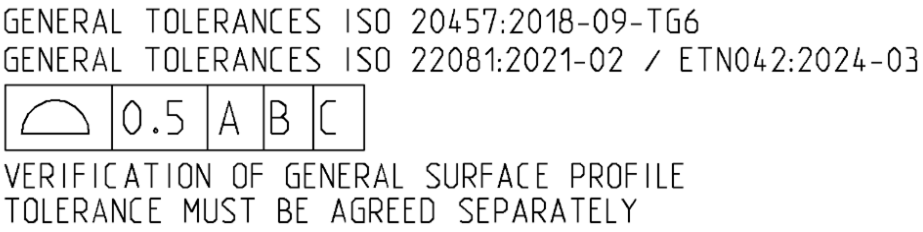

Image 6 Example ISO 20457 with tolerance grade TG6 and surface profile tolerance according to ISO 22081

9 General tolerance for rubber parts according to ISO 3302

9.1 General

ISO 3302-1:2014-07
This part specifies tolerance classes for linear dimensions and test methods for rubber parts. These tolerance classes are described in the following chapters.

ISO 3302-2:2022-05
This part specifies geometrical tolerances for rubber parts. This part is ambiguous in some respects and shall therefore not be applied as standard for general tolerances. This part can provide orientation for technologically appropriate tolerance values for flatness, parallelism, perpendicularity and position, however.

All required geometrical tolerances shall be indicated directly in the TPD.

9.2 Tolerances for moulded parts

The indication of the general tolerance according to ISO 3302-1 for rubber mouldings shall be given in or in proximity to the title block according to the following rules, see example in Image 7.

- Formulation „General tolerances“, followed by the reference to the standard ISO 3302-1:YYYY-MM,
- followed by a hyphen,
- followed by the tolerance class for limit dimensions M1 to M4,
- followed by a hyphen,
- followed by the tolerance class for flash X0 to X5,
- additionally a general surface profile tolerance according to ISO 22081 and the rules from chapter 7 of this company standard can be indicated.

For further Information see ISO 3302-1:2018-06 chapter 5.

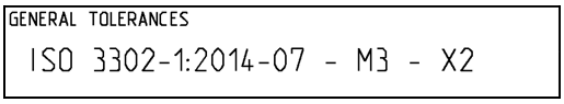

Image 7 Example ISO 3302-1 with tolerance classes M3 and X2

9.3 Tolerances for extrusions

The indication of the general tolerance according to ISO 3302-1 for rubber extrusions shall be given in or in proximity to the title block according to the following rules, see examples in Image 8 and Image 9.

- Formulation „General tolerances“, followed by the reference to the standard ISO 3302-1:YYYY-MM,
- followed by a hyphen,
- followed by one or two tolerance classes depending on the application,
- additionally a general surface profile tolerance according to ISO 22081 and the rules from chapter 7 of this company standard can be indicated.

For further Information see ISO 3302-1:2018-06 chapter 6.

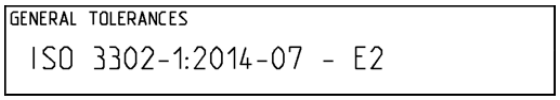

Image 8 Example ISO 3302-1 with tolerance class E2

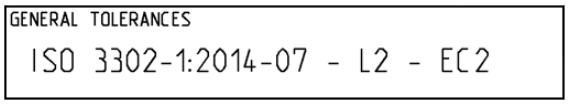

Image 9 Example ISO 3302-1 with tolerance classes L2 and EC2

9.4 Tolerances for calendered sheet

The indication of the general tolerance according to ISO 3302-1 for rubber calendered sheet shall be given in or in proximity to the title block according to the following rules, see examples in Image 10.

- Formulation „General tolerances“, followed by the reference to the standard ISO 3302-1:YYYY-MM,
- followed by a hyphen,
- followed by the tolerance class for limit dimensions for the nominal thickness ST1 to ST3,
- followed by a hyphen,
- followed by the tolerance class for nominal width SW1 to SW3,
- additionally a general surface profile tolerance according to ISO 22081 and the rules from chapter 7 of this company standard can be indicated.

For further Information see ISO 3302-1:2018-06 chapter 7.

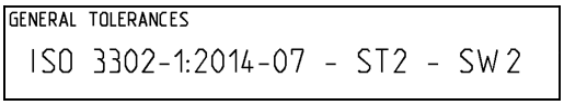

Image 10 Example ISO 3302-1 with tolerance classes ST2 and SW2

10 General tolerance for stamped parts according to DIN 6930

10.1 General

DIN 6930-1:2011-10
This part specifies delivery conditions for stamped parts produced from flat steel products with a thickness of over 0.1 mm.

DIN 6930-2:2011-10
This part specifies general tolerances for linear dimensions, radii of curvature, angular dimensions, coaxiality and symmetry for flat stamped parts and stamped parts made by forming.

There are no specifications regarding the execution of the cutting surfaces or the sizes of the cutting burr and cutting burr directions. These must be agreed separately.

10.2 Drawing indication

If the delivery conditions according to DIN 6930-1 shall be applied to the product, the following indication shall be given in or in proximity to the title block:

TECHNICAL DELIVERY CONDITIONS DIN 6930-1:YYYY-MM

The indication of the general tolerance according DIN 6930-2 shall be given in or in proximity to the title block according to the following rules, see example in Image 11.

- Formulation „General tolerances“, followed by the reference to the standard DIN 6930-2:YYYY-MM,
- followed by a hyphen,
- followed by the tolerance class.

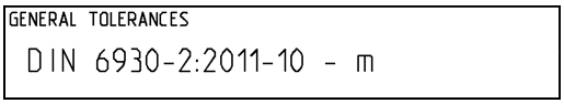

Image 11 Example DIN 6930-2 with tolerance class m

Annex A
Examples for the smallest circumscribed sphere
(informative)

Image A 1 and Image A 2 show application examples for the smallest circumscribed sphere.

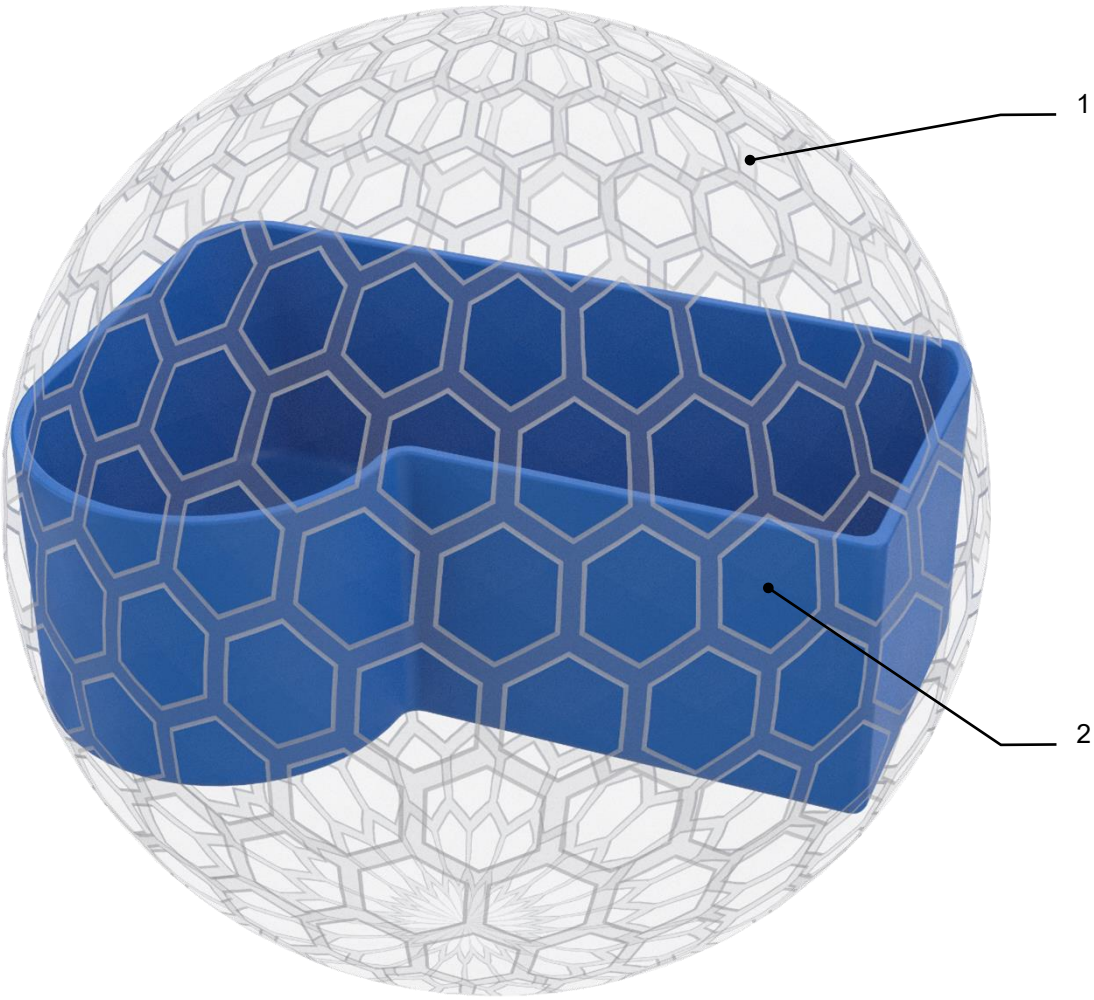

Image A 1 Smallest circumscribed sphere – Application example 1

Key:

1 Smallest circumscribed sphere
2 Component

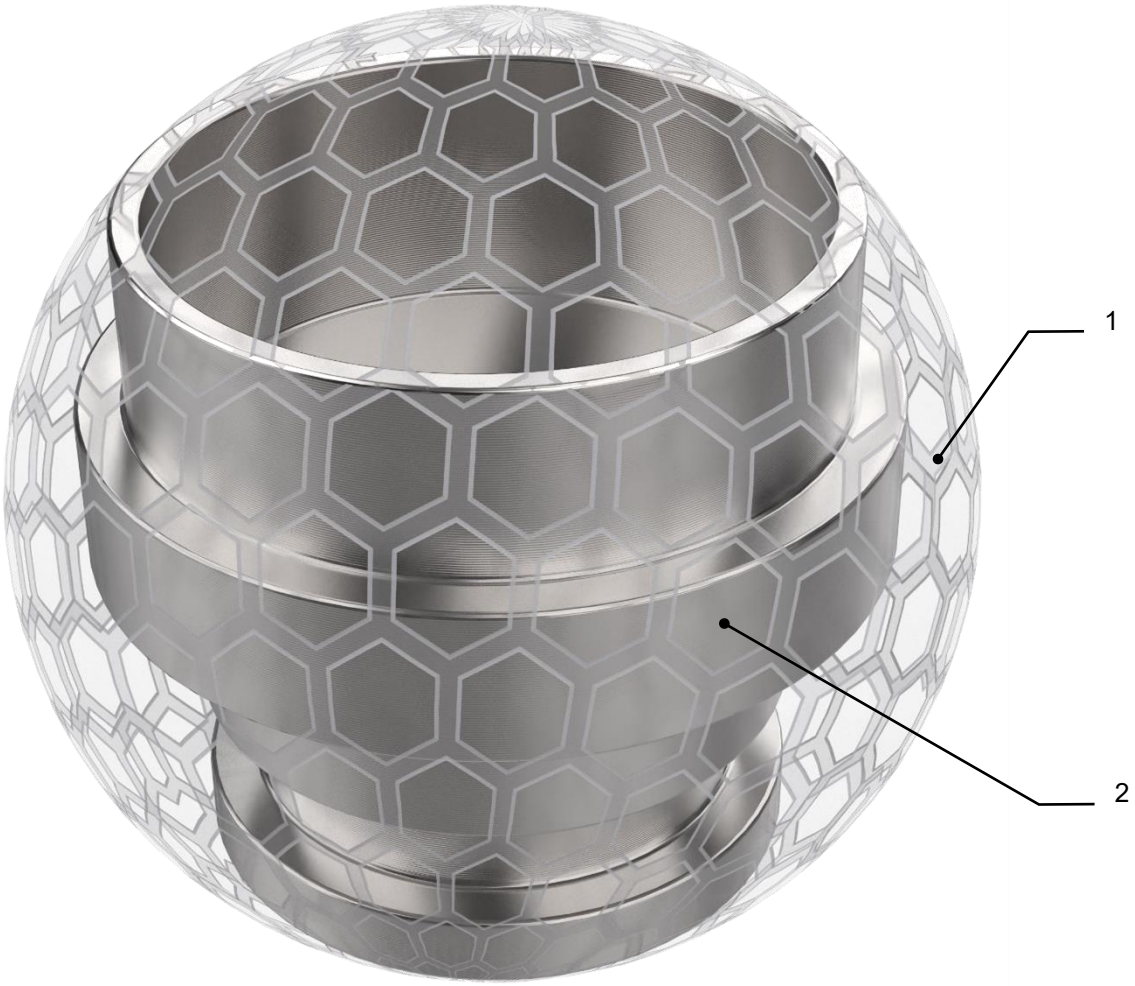

Image A 2 Smallest circumscribed sphere – Application example 2

Key:

1 Smallest circumscribed sphere
2 Component

Bibliography

ISO 14405-2 Geometrical product specifications (GPS) – Dimensional tolerancing – Part 2: Dimensions other than linear or angular sizes

ISO 3302-2:2022-05 Rubber – Tolerances for products – Part 2: Geometrical tolerances