
**Geometrical product specifications
(GPS) — Association**

Spécification géométrique des produits (GPS) — Association

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 4351:2023](https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023)

<https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 4351:2023

<https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Association specification elements description of association process.....	3
5 Association criterion.....	4
5.1 General.....	4
5.2 Objective function description.....	5
5.3 Association constraint.....	6
5.4 Material offset.....	7
6 Specification elements.....	7
Annex A (informative) Non-enclosing feature/enclosing feature — Definitions.....	11
Annex B (informative) Illustration of results of association.....	13
Annex C (informative) Relationship to the ISO GPS matrix model.....	15
Bibliography.....	16

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 4351:2023](https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023)

<https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023>

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

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 specifications (GPS) standard and is to be regarded as a general ISO GPS standard (see ISO 14638). It influences the chain links A, B, C, E, F and G in all chains of standards in the general ISO GPS matrix.

The ISO GPS matrix plan given in ISO 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 the specifications made in accordance with this document, unless otherwise indicated.

For more detailed information on the relationship of this document to other International Standards and to the ISO GPS matrix model, see [Annex C](#).

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 4351:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/e58c7e09-6d91-4ca1-92c4-55a3b50f677d/iso-4351-2023>

Geometrical product specifications (GPS) — Association

1 Scope

This document gives the terminology and basic concepts of association, including objective functions and association constraints and material offset.

This document is not intended to specify association defaults and GPS syntax which are introduced in other (ISO GPS) International Standards.

NOTE The association can be used to establish for example:

- a datum;
- a reference feature for a geometrical specification or for a surface texture specification;
- an associated toleranced feature;
- any dimensional characteristic;
- an intersection plane, an orientation plane, a collection plane or a direction feature.

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

ISO 4351:2023

ISO 17450-4, *Geometrical product specifications (GPS) — Basic concepts — Part 4: Geometrical characteristics for quantifying GPS deviations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17450-1 and ISO 17450-4 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

association

feature operation used to fit one or more ideal features to one or more *input features* (3.2) according to an association criterion

Note 1 to entry: The definition has been adapted from the definition of ISO 17450-1, to consider the term input feature.

3.2

input feature

<association> portion of an *associated feature* (3.3) or non-ideal feature, which is an extracted feature or a real feature, which can be filtered or not

3.3 associated feature

ideal feature which is fitted to an *input feature* (3.2) with a specific *association criterion* (3.5)

Note 1 to entry: An ideal feature is defined by a mathematical description using a finite set of real numbers called description parameters (see EXAMPLE below).

Note 2 to entry: An associated feature can be a feature of size. In this case, it is possible to use the term associated feature of size.

EXAMPLE An extruded surface having as directrix an ellipse, can be described by the formula

" $a \cdot (x-c)^2 + b \cdot (y-d)^2 = 1, \forall z$ " (with description parameter a, b, c and d with a non-equal to b). It describes the points (having as coordinate x, y and z , in a local Cartesian coordinate system) of an ideal feature which belongs to the prismatic invariance class (prismatic surface with an elliptic base).

3.4 restricted associated feature

set of points of an *associated feature* (3.3), where local geometrical deviations with the *input feature* (3.2) exist

3.5 association criterion

objective function (3.6) with or without *association constraints* (3.9), and with or without material offset, defined for an association

Note 1 to entry: Several association constraints may be used for one association.

Note 2 to entry: Association results (associated features) can differ, depending upon the choice of association criterion.

3.6 objective function optimization function

<association> formula that describes the goal of association from the *input feature* (3.2) and the ideal feature [*associated feature* (3.3)]

3.7 L-function

objective function (3.6) defined from the set of the signed local geometrical deviations between an *input feature* (3.2) and the *associated feature* (3.3)

Note 1 to entry: The local geometrical deviations are defined in ISO 17450-4, with the convention sign based on the material boundary defined from the ideal geometry.

3.8 S-function

objective function (3.6) based on the size of the associated feature of size

Note 1 to entry: The maximum inscribed feature and the minimum circumscribed feature are associated feature obtained with S-function.

3.9 association constraint

set of restrictions on variability of the mathematical parameters describing an *associated feature* (3.3) in the optimization process.

EXAMPLE Orientation constraint, location constraint, material constraint or size constraint are the different types of association constraint.

3.10**orientation constraint**

association constraint (3.9) related to one or more rotational degrees of freedom of *associated feature* (3.3)

3.11**location constraint**

association constraint (3.9) related to one or more translational degrees of freedom of *associated feature* (3.3)

3.12**material constraint**

association constraint (3.9) on the *associated feature* (3.3), in relation to the material boundary of the *input feature* (3.2)

EXAMPLE The outside material constraint implies that all distances between the associated feature and the input feature are negative or equal to zero.

3.13**size constraint**

association constraint (3.9) on the size of *associated feature* (3.3)

Note 1 to entry: Without size constraint, the size of associated feature is variable for the association.

4 Association specification elements description of association process

The association operation is an optimization process intended to fit an ideal feature with a predefined geometry to an input feature or to fit a collection of ideal features to predefined geometries to a collection of input features. The input feature for this optimization process is a geometrical feature (portion of an associated feature, an extracted feature or a real feature, which can be filtered or not).

To perform this optimization process, an association objective function shall be specified without or with association constraints. After this step of optimization, an offset step can be optionally performed (see [Figure 1](#)).

An associated feature or a collection of associated features is thus defined from which it is possible to specify the set of one or more situation features (allowing the situation in the space of this associated feature or this collection of associated features).

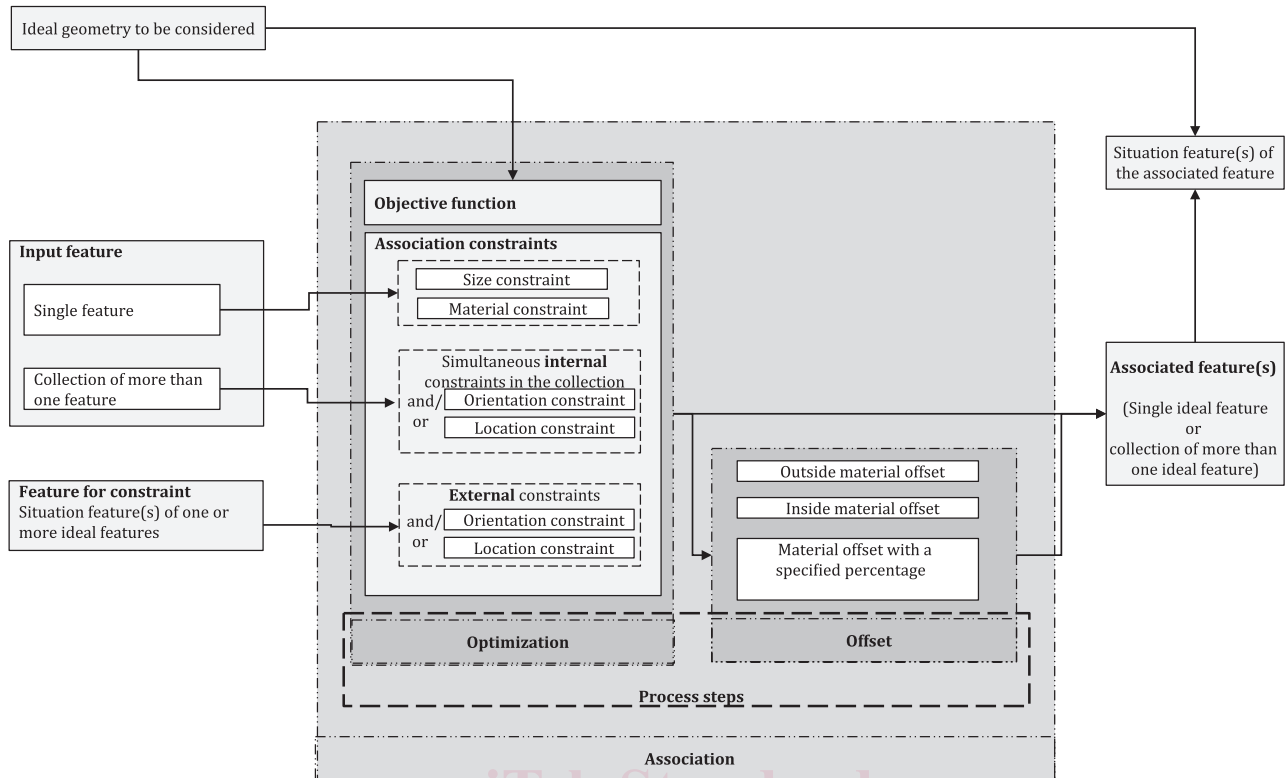


Figure 1 — Concept diagram illustrating the association process

If associations are performed on more than one non-ideal single features (input features), then the associations can be made:

- Independently.
- Simultaneously, i.e. the collection of associated features is established simultaneously with location constraints (if applicable) and orientation constraints (if applicable) between them. Those are internal constraints in the collection of the ideal features (to be associated).
- In a specific order, i.e. the associated feature of the rank $n+1$ is established with location constraints (if specified) and orientation constraints (if specified) related to the situation feature(s) of the associated feature(s) of rank 1 to n . Those are external constraints of ideal feature(s) of rank $n+1$ from associated feature(s) of rank n .

5 Association criterion

5.1 General

An association criterion specifies an optimization process combining an objective function and association constraints optionally followed by a material offset.

The objective function shall be specified from an S-function or an L-function:

- the first one, by maximizing or minimizing the size of the associated feature of size, by considering no association constraint or one or more association constraints but without size constraint;
- the second one, through an optimization of a function of the set of signed local geometrical deviations with or without association constraint.

The local geometrical deviations are established between the points on the input feature and the corresponding points on the associated feature. This set of the points defines a restricted associated