# NATIONAL STANDARD OF THE

# PEOPLE'S REPUBLIC OF CHINA



# GB/T 17851-2022

## Geometrical product specifications (GPS) - Geometrical tolerancing - Datums and datum systems

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## 1 Scope

This document specifies the terminology, rules and methods related to the marking and understanding of datums and datum systems in product technical documentation. This document also provides corresponding explanations of the concepts involved to facilitate understanding.

This document defines a set of normative operations for establishing datums and datum systems (see GB/T 24637.2). Its inspection operation set (see GB/T 24637.2) can take different forms (physical simulation or mathematical association); however, this is not the content discussed in this document.

Note: GB/T 16671 gives detailed rules on the maximum material requirements and minimum material requirements of the datum.

This document applies to product geometric technical specifications related to datums and datum systems.

## 2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to the date applies to this document; for undated reference documents, the latest version (including all amendments) applies to this document.

GB/T 1182-2018 Geometrical product specifications (GPS) - Geometrical tolerancing - Tolerances of form, orientation, location and run-out (ISO 1101:2017, MOD)

GB/T 16671-2018 Geometrical product specifications (GPS) - Geometrical tolerancing - Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR) (ISO 2692:2014, MOD)

GB/T 24637.1 Geometrical product specifications (GPS) - General concepts - Part 1: Model

for geometrical specification and verification (GB/T 24637.1-2020, ISO 17450-1:2011, MOD)

- Composite surface (e.g. a free-shaped curved surface).

Each single feature or collection feature belongs to an invariance class (see Appendix B for explanations of invariance class, degrees of invariance, degrees of freedom).

Association features are established from actual single datum features or extracted single datum features. Association features can be determined through association, which include constraints on the feature itself or constraints relative to one or more other features. The orientation features that constitute the datum are determined by these association features. See Appendix A for the default association method.

One or more single features can be used to establish a datum. If only a single feature is used, a single datum is established. If multiple single features are used, these features may either be considered simultaneously to establish a common datum, OR they may be established in a defined order to establish a datum system (see 6.3).

All datum features used to establish datums shall be clearly marked.

A single datum (see 6.3.2), a common datum (see 6.3.3) or a datum system (see 6.3.4)

in the geometric specification shall be clearly defined.

For the association, if any additional constraints are required, they shall be defined.

Note 1: Datums and datum systems are geometric features, not coordinate systems. Coordinate systems can be established on datums.

Note 2: This document does not provide the expression of the coordinate system. This part of the content may be added in subsequent versions or amendments of GB/T 17851.

Example: The single datum marked in Figure 4 is derived from actual features that are cylindrical in the nominal state, which is used to orient or locate the tolerance zone. In order to export this datum, the following shall be done:

- Separation: To determine the actual composition surfaces corresponding to the nominal features [see Figure 4b)];

- Extraction: To obtain the extracted integral features [see Figure 4c)];

- Filtering: See Appendix A;

- Association: (Association method according to Appendix A) to determine the association features. (In this example, the association features are of the same type as the nominal features) Fit features [see Figure 4d)] are established from non-ideal surfaces (in the specification operation set) or from extracted features (in the inspection operation set).

The datum is the situation feature (axis) of the association cylinder [see Figure 4e)].

The intrinsic characteristics introduced by the combination of features (determining the relationship between association features), by default, shall maintain their theoretically correct linear and angular dimensions.

Example: The common datum is established by two parallel cylinders with different axes (Invariance class: Prismatic). Every single cylinder has one intrinsic characteristic: its diameter.

The combination of these two features also has intrinsic characteristics: the angle determined by the actual two axes limits the torsion of the datum; the distance between the two axes (see C.2.4). By default, the diameters of the two cylinders are variable; the torsion angle and distance between the two cylinders remain theoretically correct.

Note: In special cases, using the modifier [DV], the distance between features can be variable when combined, see 6.3.3, 7.4.2.7, 7.4.2.9.

6.2.4 A datum system established by two or more single datum features in a specified order The intrinsic characteristics of each association feature used to establish the datum system shall comply with the provisions in 6.2.2.

The intrinsic characteristics introduced by the combination of features (determining the relationship between association features), by default, shall have variable linear dimensions; however, the angular dimensions shall remain theoretically correct.

6.3 Single datum, common datum, datum system

6.3.1 General requirements When a single surface or a collection surface is marked as a datum feature, the invariance of these surfaces shall be compared and identified in accordance with Table B.1, to confirm the type of the corresponding situation feature that constitutes the datum (point, straight line, plane, spiral line, or a combination thereof).

6.3.2 Single datum A single datum contains one or more situation features; its situation features can be based on the entirety of a single feature or a part of a single feature.

Note: The single datum of a cone has two situation features: the axis of the cone and a point on that axis.

If there is only one common datum in the tolerance frame, or the common datum is the primary datum of the datum system, there are no external orientation constraints and location constraints in the combination operation of the association features, when establishing the datum. Therefore, these surfaces (forming the collection surface) are associated together. For the constraint specification of the common datum as the "secondary datum" or "tertiary datum", see 6.3.4.

If the primary datum is sufficient to constrain the degrees of freedom of the tolerance zone, the secondary datum shall not be given.

If the primary datum and the secondary datum are sufficient to constrain the degree of