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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 42869-2023

**Requirements for three-dimensional model simplification and
lightweight of mechanical products**

机械产品三维模型简化与轻量化要求

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Foreword

This document was issued on 6 August 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 December 2023.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 42869-2023 covers the simplification and the lightweighting of three-dimensional models of mechanical products - the two operations by which a full-detail design model is reduced to something a downstream user can actually open and work with. After the terms and the abbreviations, the simplification clause is organised by where the reduction

happens: general requirements first, then part modelling, assembly model applications, finite element modelling, and models prepared for issue. The lightweighting clause follows the same pattern but by purpose: general requirements, collaborative research and development, assembly simulation, three-dimensional process documents, three-dimensional electronic interactive publications, and visual display. Two informative annexes give worked examples of each operation. The problem behind that structure is that one model serves audiences with opposite needs. A simulation model wants small features gone; a supplier needs geometry that still measures correctly; a service publication needs a file that opens on an ordinary laptop. Left to individual judgement, each group reduces the model in its own way, the versions drift apart, and nobody can say afterwards which of them the released drawing was made from. It is used by design and simulation teams, CAD and product data management administrators, technical publication groups, and the software vendors whose export settings have to answer these categories.

This document specifies the requirements for simplification and lightweight of three-dimensional models of mechanical products.

This document is suitable for three-dimensional model construction of mechanical products and simplification and lightweight processing in application scenarios such as simulation, visualization, data sharing and exchange.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 24734.11, Technical product documentation -- Digital product definition data practices -- Part 11: Levels of geometrical detail

GB/T 26099.1, General principles of three-dimensional modeling for mechanical products -- Part 1: General requirements

GB/T 26099.2, General principles of three-dimensional modeling for mechanical products -- Part 2: Part modeling

GB/T 26099.3, General principles of three-dimensional modeling for mechanical products -- Part 3: Assembly modeling

GB/T 26100, General principles of digital mock-up for mechanical products

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 26099.1, GB/T 26099.2, GB/T 26099.3, GB/T 26100 as well as the followings apply.

3.1 simplification

A three-dimensional model construction or processing method that allows certain features not to be constructed, certain parts or components not to be assembled,

f) Name the simplified model file in accordance with the provisions of GB/T 26099.1.

Consider the inheritance with the original model name.

5.2 Simplification requirements in part modeling

5.2.1 Three-dimensional model simplification in part modeling meets the following requirements:

- a) The external interface of the model shall not be simplified and its assembly shall not be affected;
- b) Some features related to manufacturing, such as internal threads, external threads, undercuts, etc., are allowed to be omitted or simplified in expression. However, when the simplified model is used for projection to generate two-dimensional engineering drawings, it shall meet the relevant regulations of mechanical drawing;
- c) For several groups of holes with the same diameter and distributed in a certain regular pattern, only one feature can be constructed. Other similar features can be simplified by the center line;
- d) Features such as printing, engraving, and knurling allow simplified expression in the form of stickers. When necessary, it can also be accompanied by comments;
- e) When modeling standard parts and purchased parts, the internal structure unrelated to installation is allowed to be simplified, but basic information that affects the model assembly design such as the maximum geometric outline, installation interface, extreme position, and mass attributes shall be included;
- f) Under the conditions that meet the usage requirements, low-order surfaces can be

used instead of high-order surfaces.

5.2.2 See Figure A.1 in Annex A for a simplification example in part modeling.

5.3 Simplification requirements for assembly model applications

5.3.1 Three-dimensional model simplification for assembly model applications meets the following requirements.

a) When assembly models are used for visual display, such as in digital factories or digital production line visual display applications, for assembly models of production lines, machine tools, logistics and other equipment, if the internal details do not need to be displayed, a simplified method without assembly can be used. If some external subtle features do not affect the display effect, simple shapes (cylinder, cube, etc.) can be used instead of the simplified method of complex shapes.

b) Generally, it is advisable to remove the modeling history information in the original model and base it on the business needs of different application scenarios in a). Choose to retain, partially remove or completely remove assembly structure, annotations, attributes, views, colors and other information;

c) The lightweight model formed after surface processing can reduce the size of the model file through surface reduction, merging primitives, deleting invisible surfaces, patching or deleting holes, etc., so as to meet the requirements of the visualization software and hardware system;

d) For point cloud models obtained by reverse engineering methods, it is advisable to convert mesh surfaces into NURBS surfaces or other parameter expressions to reduce model file size;

e) For a large number of repeated parts, only the geometric data of one part can be recorded, but the position information of all parts shall be saved to reduce the amount of data. At the same time, the recorded geometric data information of the parts and all parts shall be used during the visualization process. location information to reconstruct all parts and position them correctly;