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**The data content and its organization of digital definition of
mechanical products**

机械产品数字化定义的数据内容及其组织

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Foreword

Annex A, Annex B and Annex C of this guiding technical document are all informative annexes.

This guiding technical document was proposed by, and is under the jurisdiction of, the China National Institute of Standardization. The drafting organization is the China National Institute of Standardization. The main drafters are Wang Ping, Fan Yuqing, Lin Xiaoxing, Qin Guangli and Zhan Junfeng.

Introduction

In the change of the design method of mechanical products from the traditional manual way to computer-aided design, the traditional way of describing a mechanical product by paper

documents is being replaced by the digital definition of the product. Where a mechanical product uses computer-aided design, and in particular a solid model of the product, the geometric information of the product design is entirely digital and the drawing information of the product is generated from the corresponding three-dimensional model; this raises the question of how the digital information of the product is to be organized, that is, the question of the content, the format and the structure of the digital definition of the product. Only with a unified method of digital product definition can the design department pass the definition information of the product correctly and completely to the manufacturing department, and can enterprises interchange the digital definition information of a product conveniently. It should be noted here that the data organization of the digital definition of a product should not depend on any particular CAD system: it is a description of the digital information of the product.

The national drawing standards drawn up in China for paper documents will continue to be used in the method of digital product definition.

The purpose of drawing up this guiding technical document is to specify the basic rules and the data organization of the digital definition of a product, the main content being the engineering data set and the part list. The engineering data set is the result of product design and includes the geometric model, the set of drawing instructions and the data set information. In practical application the engineering data set may be in a standard format, such as STEP data, or in a non-standard format, that is, data defined by the CAD system itself. The part list is an electronic data table whose content is the non-geometric data of the engineering parts; the use of the part list makes it convenient to organize and interchange the digital definition of parts from product design and process design through to machining.

This guiding technical document and the national standard GB/T 16656, Industrial automation systems and integration - Product data representation and exchange (the STEP standard), complement one another: the content of this guiding technical document is directed mainly at the content and organization of product definition data, while the content of the STEP standard is mainly the standardization of formal methods of describing product data and of methods of implementing data interchange.

1 Scope

This guiding technical document specifies the data content of the digital definition of mechanical products and the way it is organized, including the rules of digital definition, the engineering data set and the part list.

This guiding technical document applies to the organization and management of mechanical product data by design staff using CAD systems and the related software, so as to make data interchange between computer-aided design systems and related systems convenient.

The formal methods of expressing product data and the methods of implementing data interchange, which are the subject of the national standards GB/T 16656 and GB/T 14213, are outside the scope of this guiding technical document.

2 Normative references

The provisions in the following documents become provisions of this guiding technical document through reference in it. For dated references, subsequent amendments (excluding corrections) or revisions do not apply; for undated references, the latest edition applies.

GB/T 14213, Initial graphics exchange specification

GB/T 14665, Mechanical engineering - CAD drawing rules

GB/T 15049.1, Graphic files of standard parts - General rules of preparation

GB/T 15751, Technical product documentation - Computer-aided design and drafting - Vocabulary

GB/T 16656, Industrial automation systems and integration - Product data representation and exchange

GB/T 17825, CAD file management

GB/T 18784, CAD/CAM data quality

Note: in application GB/T 14213 is also known as the IGES standard and GB/T 16656 as the STEP standard.

3 Terms and definitions

The terms and definitions established in GB/T 15751 and the following apply in this guiding technical document.

3.1 element - the basic unit making up a product, the smallest unit that cannot be decomposed further in manufacture, or a combination of two or more elements joined into one that need not and cannot be decomposed in use. 3.2 composition part - a unit formed from parts by simple assembly or combination; it may also be understood as a simple assembly, and is called a component for short. 3.3 assembly - a unit formed from parts and composition parts joined together by assembly of various forms. Note: an assembly may be divided into detachable and non-detachable assemblies, and may itself be made up of smaller assemblies.

3.15 variational configuration - the configuration of parts selected to suit the special requirements of different customers for the product, also called the customer configuration.

3.16 drawing change notice - the form issued together with the drawing, used to state the

content of an engineering change when a new or changed drawing is released. 3.17 advance drawing change notice - the form used when a change to a drawing is issued before that drawing is released.

3.18 program identification number - the engineering identifier of the product, the code given by decomposing the product structure and defined in the work breakdown structure (WBS). 3.19 part list - the electronic data table containing the non-geometric data of the engineering parts. 3.20 work breakdown structure - the product-centred hierarchical system structure formed through systems engineering work during project management.

3.21 digital pre-assembly - the process of checking, according to the needs of design, analysis or tooling, whether there is interference among the parts during assembly, the state of the mating faces and the various states of design integration, using several computer files containing the spatial arrangement of the parts, the assemblies or the installation items. The process is in effect a pre-assembly simulation of the designed product object on the computer.

4 Abbreviated terms

The following abbreviated terms are used in this guiding technical document. ADCN: Advance Drawing Change Notice. BOM: Bill of Material, also called the parts list. CSG: Constructive Solid Geometry. DCN: Drawing Change Notice. IGES: Initial Graphics Exchange Specification. NHA: Next Higher Assembly. STEP: Standard for The Exchange of Product model data. WBS: Working Breakdown Structure.

5 Rules for the digital definition of a product

5.1 Content of the digital definition of a product. The digital definition of each part of a product comprises two items: the engineering data set and the part list. They are organized by part number and together form the basic data unit of the product definition. As the complete information of the product design, the digital definition of the product is released and controlled by the engineering data management department and passed to the manufacturing department.

Logically the engineering data set is the data collection of the digital definition of the product and is the design result of the engineering design department. Within the engineering data set, the product-related information - the geometry, the structure and the process of parts, assemblies and installation items - is organized in one or several CAD models according to a definite logical structure.

5.3.3.2 Choice of line type for a wireframe: a solid line is used for a boundary line; a dash-dot line for a datum line or a centre line; a dash-double-dot line for the remaining parts of the wireframe. 5.3.3.3 Layering of wireframe elements: the wireframe elements defining all the edges of a part are placed on one layer, including any non-standard open wireframe;