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Industrial automation systems and integration — Product data representation and exchange —

Part 224: Application protocol: Mechanical product definition for process planning using machining features

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Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits —

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Partie 224: Protocole d'application: Définition de produits mécaniques pour la planification de procédés utilisant des caractéristiques d'usinage

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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.

International Standards are drafted in accordance with the rules given in ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10303-224 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*. This second edition cancels and replaces the first edition (ISO 10303-224:1999), of which it constitutes a technical revision.

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This International Standard is organized as a series of parts, each published separately. The structure of this standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

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— Parts 11 to 14 specify the description methods;

— Parts 21 to 29 specify the implementation methods;

— Parts 31 to 35 specify the conformance testing methodology and framework;

— Parts 41 to 50 specify the integrated generic resources;

— Parts 101 to 107 specify the integrated application resources;

— Parts 201 to 237 specify the application protocols;

— Parts 301 to 337 specify the abstract test suites;

— Parts 501 to 520 specify the application interpreted constructs.

A complete list of parts of ISO 10303 is available from the Internet:

<http://www.nist.gov/sc4/editing/step/titles/>

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Should further parts of ISO 10303 be published, they will follow the same numbering pattern.

Annexes A, B, C, D and E form a normative part of this part of ISO 10303. Annexes F, G, H, J, K and L are for information only.

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Introduction

ISO 10303 is an International Standard for the computer-interpretable representation production information and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application protocols, application interpreted constructs, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application protocol series.

This part of ISO 10303 specifies an application protocol (AP) for the representation of information needed to produce a mechanical part definition for process planning of a single piece or an assembly of piece parts for machining operations, and specifies the integrated resources necessary to satisfy these requirements.

This application protocol defines the context, scope, and information requirements for the representation of information needed to produce a mechanical part definition. These requirements specify the part identification, tracking, shape, representation of the shape and material data necessary for the definition of a part for process planning. The process planning function in an organization can be assisted a great deal by identifying machining oriented part shape features so that the process planner can more readily identify machining tools and processes to manufacture a part.

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This application protocol identifies specific characteristics of part shape used in manufacturing. These characteristics are used to define manufacturing features. These shapes may be represented either by machining features defined in this application protocol, or by a boundary representation solid model, shared by other application protocols and used as application interpreted constructs in this part. The purpose of manufacturing features is to facilitate the identification of manufacturing shapes that are human and computer interpretable. Manufacturing features allow information about the shape to be used for decisions in computerized process planning systems.

Information about the part material is supplied so the process planning activity can determine equipment and material requirements. Also supplied is administrative information necessary for tracking customer information, supplier information about the part, and internal control information for the manufacturing operation to support process planning. Tracking of certain administrative information is a component of the iterative process for creating a process plan.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model, is given in annex G.

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Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in Annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

Figure 1 contains the data planning model that provides a high level description of the requirements for this application protocol. This planning model was created from the in-scope data from the activities of the application activity model (AAM) and grouped into logical units of functionality. This planning model is used as a guide in developing the application reference model (ARM).

This edition of this part of ISO 10303 incorporates modifications that are upwardly compatible with the previous edition, and modifications that are not upwardly compatible with the previous edition. Modifications to EXPRESS specifications are upwardly compatible if:

— the modifications do not result in changes to instances that are encoded according to ISO 10303-21; such instances conform to both the unmodified and modified EXPRESS specifications;

— the modifications do not result in changes to software that conforms to ISO 10303-22 with respect to access to the data content of data structures;

— the modifications do not invalidate mappings to the previous edition of this part of ISO 10303 that are specified in the mapping table of an ISO 10303 application protocol.

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Technical modifications that are upwardly compatible or are not upwardly compatible with ISO 10303-224:1999 are summarized in annex L. A brief summary of the modifications are the following:

— New Manufacturing_features which include Cutout, Recess, Rib_top, and Shape_profile;

— Enhancements to existing features and feature_definition_items which include Planar_face, Ngon_profile, Ngon_base_shape, and new sub-type for Boss which is a Rectangular_boss;

— Increased scope from the manufacture of a single piece part to the manufacturing of an assembly of piece parts;

— Modified Manufacturing_part_properties entities found in error in the first edition (ISO 10303-224:1999);

— Modified several information requirements and corresponding application interpreted model entities to support harmonization with other application protocol;

— Normatively reference all of the current second edition and technical corrigendum parts of ISO 10303.

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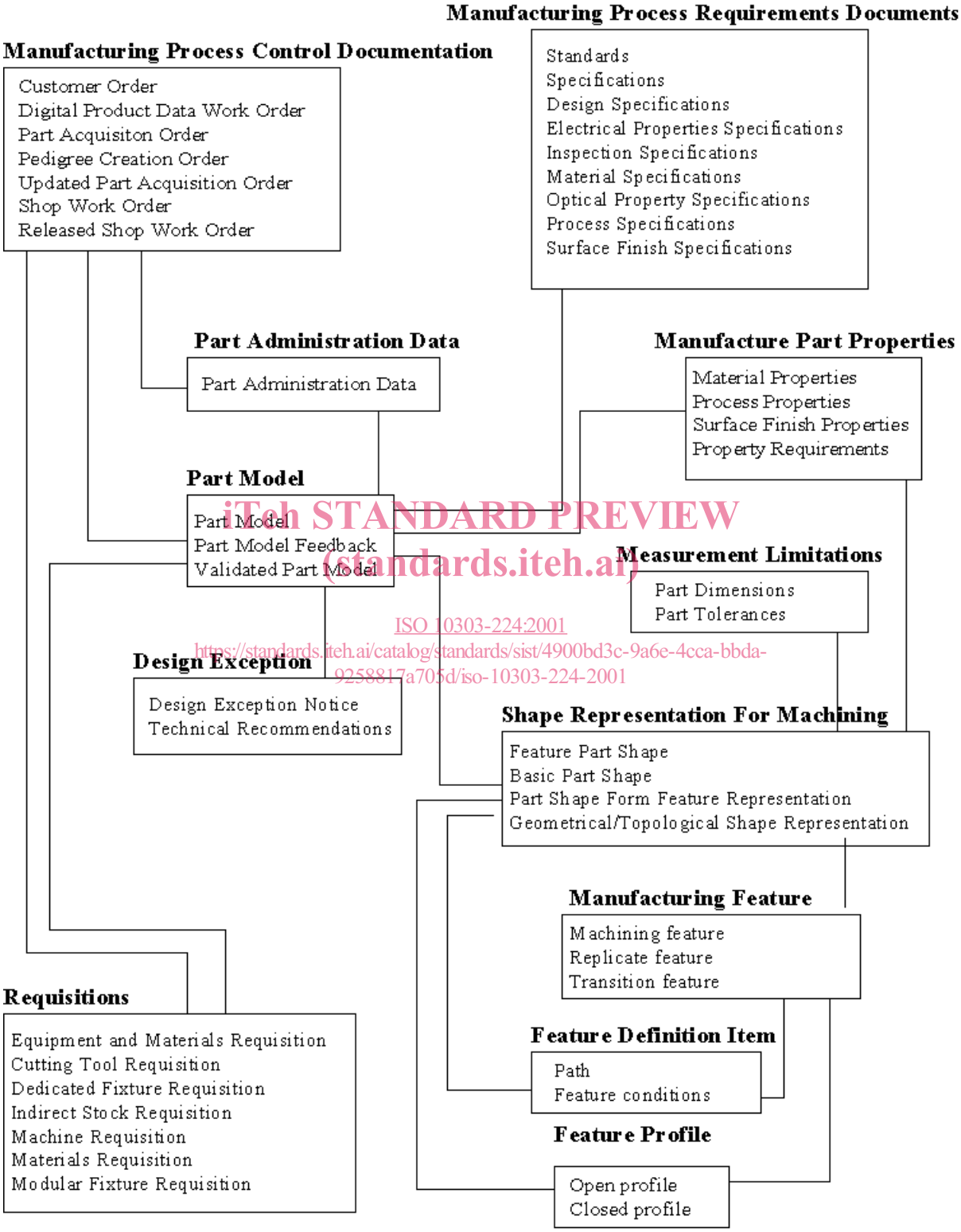

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Figure 1 - Data planning model

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1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the representation and exchange of information needed to define product data necessary for manufacturing a single piece or assembly of mechanical parts. The product data is based on existing part designs that have their shapes represented by machining features. This part supports digital representation for computer integrated manufacturing.

NOTE 1 - The application activity model in annex F provides a graphical representation of the process and information flows which are the basis for the definition of the scope of this Part of ISO 10303.

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The following are within the scope of this part of ISO 10303:

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— the manufacture of a single piece mechanical part, and assemblies of single piece parts for manufacturing purpose;

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— parts that are to be manufactured by either milling or turning processes;

— machining features for defining shapes necessary for manufacturing;

NOTE 2 - The machining feature set is defined in this part of ISO 10303.

— Explicit representation of the 3D shape of machining features through bounded geometry representations;

— implicit representation of machining features through selection of standard parameters;

— machining feature definition elements necessary for creating machining form features;

— customer order administrative data to track receipt of an order for a part to the shop floor, but not including tracking of the order on the shop floor;

— approval data to authorize the manufacture of a part;

— requisition administrative data to identify requirements and track the status of materials and equipment needed to manufacture a part;

— work order data to track and identify the status of a part;

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