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

Part 240: Application protocol: Process plans for machined products

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

Partie 240: Protocole d'application: Plan des processus pour produits usinés

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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 the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10303-240 was prepared by Technical Committee ISO TC184/SC4, *Industrial automation systems and integration*, Subcommittee *SC4 Industrial data*.

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

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the 200 series.

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

<http://www.tc184-sc4.org/titles/>

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Introduction

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

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 exchange, archiving and sharing of computer-interpretable process plans for numerical control and manually machined parts. The intent of this AP is to allow for the exchange, archiving and sharing of data between dissimilar Computer-Aided Process Planning (CAPP) systems.

A process plan is a set of instructions. These instructions are used by programmers to generate machine tool controller programs which, when executed, drive the tool motion to remove material. Process planning takes place after the preliminary engineering design is completed but before the manufacturing process has begun, and the process plan effort requires feedback for design completeness. Design information is communicated to a process planner who identifies the manufacturing steps necessary to transform the material specified by the design into a product.

This AP specifies the data contained within a process plan as opposed to the data necessary to perform process planning functions. Included in this AP are the relationships that exist between the different process plan data items as well as the relationships that exist between these data items and the product definition data. Product definition data includes data items from design process such as geometry, surface finish and machining tolerance.

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This application protocol defines the context, scope, and information requirements for digitally represented process plans for numerical control and manually machined parts and specifies the integrated resources necessary to satisfy these requirements.

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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.

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.

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Figure 1 contains the data planning model that provides a high-level description of the requirements for this application protocol, as well as identifying that some relationship exists between the basic data components.

The planning model illustrates that an process plan is composed of one or more sequenced activities. The activities can be broken into several closely related sub-activities. Activities are associated with the product definition data and will be used in the production of the product shape data. Each activity describes in detail the associated processing and the type and amount of resource required with additional special instructions, if necessary. An process plan also includes administrative data pertinent to the management of the process plan.

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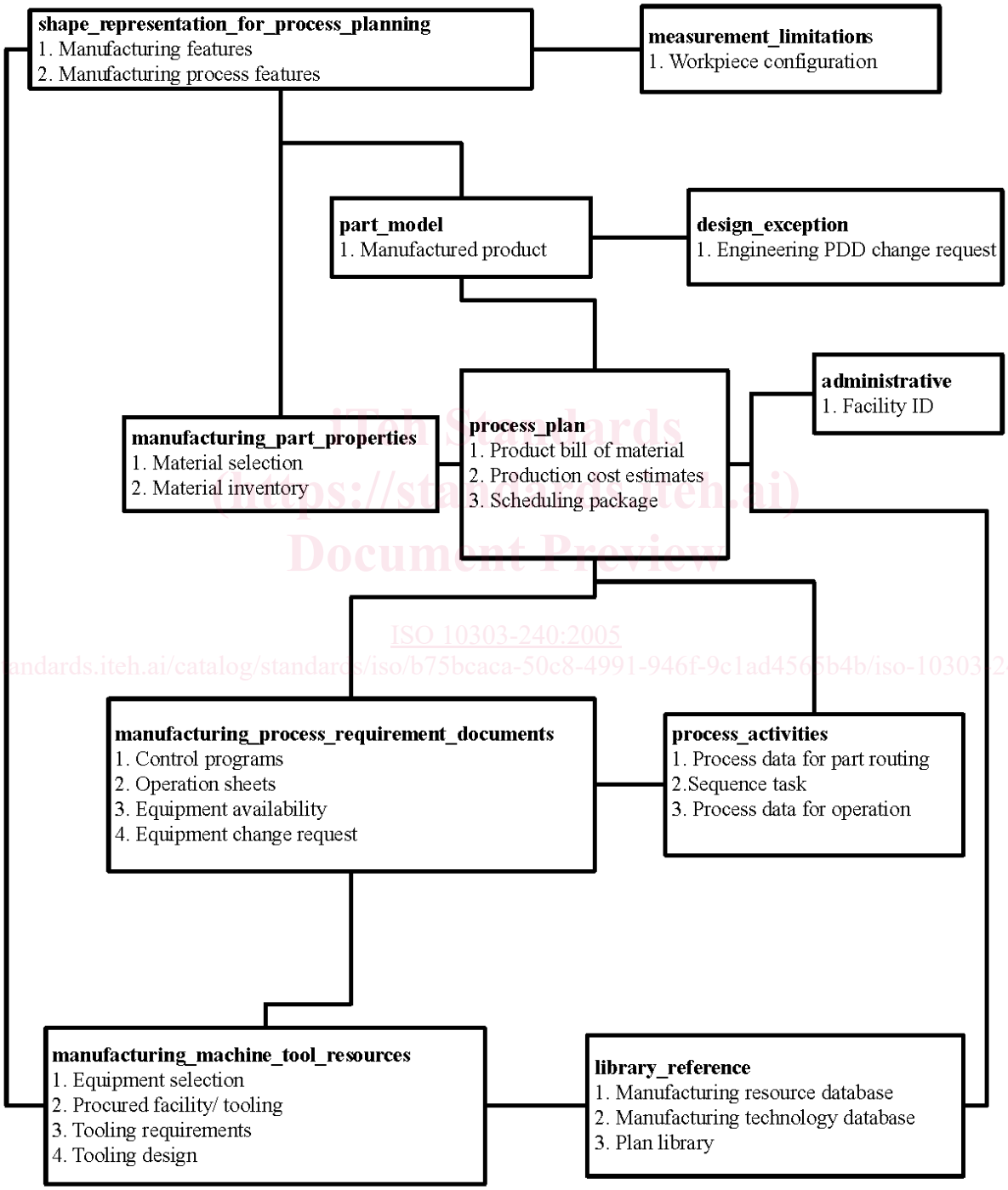

Figure 1 — Process planning data planning model

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

Part 240: Application protocol: Process plans for machined products

1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange, sharing and long term data retention of computer-interpretable process plan information for both numerical control (NC) and manually operated applications, and associated product definition data.

NOTE 1 The application activity model in Annex F provides a graphical representation of the processes and information flows which are the basis for the definition of the scope of this part of ISO 10303.

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

— information out of the planning activity that is contained in the process plans for machined parts which includes:

  — numerical controlled machines;

  — manual operations.

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

  — process data for part routing which includes manufacturing process and setup sequencing;

  — process data for operation.

— interface for capturing technical data out of the upstream application protocols which includes:

  — product definition data, including tracking a design exception notice of a part;

  — initial material definition data.

— technical data for and/or out of the process planning for machined pats which includes:

  — machining features for defining shapes necessary for manufacturing;

  — machining feature classification structure;

  — geometric and dimensional tolerances of the parts being manufactured;

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— materials, and properties of the parts being manufactured.

— references to standards and specifications declared in the process plan;

— work instructions for the tasks required to manufacture a part, using which include:

— references to the resources required to perform the work;

— the sequences of the work instructions;

— relationships of the work to the part geometry.

— information required to support NC programming of processes specified in the process plan;

NOTE 2 This includes product definition, administrative data, machine, tooling, and material requirements.

— information required to support in-process inspection specified in the process plan;

NOTE 3 In-process inspection includes such tasks as using gauge blocks or performing a probing operation to verify the dimensional constraints placed upon the part.

— shop floor information specified in the process plan;

— information for production planning specified in the process plan;

NOTE 4 Information for production planning contains items such as process data for part routing and required resource to perform the planned activity.

NOTE 5 Shop floor information contains such items as part routing, machine setup, and part loading instructions.

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

— NC program, source programs, and specific machine tool controller codes;

— NC process information derived from, or required for, manufacturing preplanning activities;

NOTE 6 This includes information from activities such as factory capacity planning, scheduling, producibility analysis, and statistical process control.

— continuous processes;

NOTE 7 Continuous process is the control of a process that requires feedback to determine new parameters such as those in adaptive control, real-time inspection and automatic corrections and in the manufacture of chemical and plating products.

— inspection processes that require an inspection plan;

NOTE 8 Inspection processes refer to inspection that occurs outside the context of the NC machining process, such as removing the part and remounting it on a Coordinate Measuring Machine (CMM).

— drawing and production illustration contents;

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— make or buy analysis activities;

— actual costing data;

— production control and scheduling analysis;

— production planning functions;

— actual execution of the process plan or associated NC programs.

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.

ISO 8824-1, *Information Technology — Abstract Syntax Notation One (ASN.1) — Specification of Basic Notation — Part 1.*

ISO 10303-1, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles.*

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ISO 10303-11, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual.*

ISO 10303-21, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure.*

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ISO 10303-31, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework: General concepts.*

ISO 10303-41, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resources: Fundamentals of product description and support.*

ISO 10303-42, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resources: Geometric and topological representation.*

ISO 10303-43, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resources: Representation structures.*

ISO 10303-44, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resources: Product structure configuration.*

ISO 10303-45, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resources: Materials.*

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ISO 10303-47, *Industrial automation systems and integration — Product data representation and exchange — Part 47: Integrated generic resources: Shape variation tolerances*.

ISO 10303-49, *Industrial automation systems and integration — Product data representation and exchange — Part 49: Integrated generic resources: Process structure and properties.*

ISO 10303-501, *Industrial automation systems and integration — Product data representation and exchange — Part 501: Application interpreted construct: Edge-based wireframe.*

ISO 10303-502, *Industrial automation systems and integration — Product data representation and exchange — Part 502: Application interpreted construct: Shell-based wireframe.*

ISO 10303-507, *Industrial automation systems and integration — Product data representation and exchange — Part 507: Application interpreted construct: Geometrically bounded surface.*

ISO 10303-509, *Industrial automation systems and integration — Product data representation and exchange — Part 509: Application interpreted construct: Manifold surface.*

ISO 10303-510, *Industrial automation systems and integration — Product data representation and exchange — Part 510: Application interpreted construct: Geometrically bounded wireframe.*

ISO 10303-511, *Industrial automation systems and integration — Product data representation and exchange — Part 511: Application interpreted construct: Topologically bounded surface*.

ISO 10303-512, *Industrial automation systems and integration — Product data representation and exchange — Part 512: Application interpreted construct: Faceted boundary representation.*

ISO 10303-514, *Industrial automation systems and integration — Product data representation and exchange — Part 514: Application interpreted construct: Advanced boundary representation.*

ISO 10303-519, *Industrial automation systems and integration — Product data representation and exchange — Part 519: Application interpreted construct: Geometric tolerances.*

ISO 10303-522, *Industrial automation systems and integration — Product data representation and exchange — Part 522: Application interpreted construct: Machining features*.

ISO 13584-26, *Industrial automation systems and integration — Parts library — Part 26: Logical resource: Information supplier identification*.

ISO 13584-42, *Industrial automation systems and integration — Parts library — Part 42: Description methodology: Methodology for structuring part families*.

IEC/ISO Directives, Part 2, *Rules for the structure and drafting of International Standards*, Fourth edition, 2001.

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