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

Part 202: Application protocol: Associative draughting

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

Partie 202: Protocole d'application: Dessin technique associatif

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Foreword

The International Organization for Standardization (ISO) 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.

Draft International Standards adopted by 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.

International Standard ISO 10303-202 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration — Product data representation and exchange*:

— Part 1, Overview and fundamental principles;

— Part 11, Description method: EXPRESS language reference manual;

— Part 12, Description method: EXPRESS-I language reference manual;

— Part 13, Description method: Architecture and methodology reference manual;

— Part 21, Implementation method: Clear text encoding of the exchange structure;

— Part 22, Implementation method: Standard data access interface specification;

— Part 23, Implementation method: C++ language binding to the standard data access interface;

— Part 24, Implementation method: C language binding to the standard data access interface;

— Part 26, Implementation method: Interface definition language binding to the standard data access;

— Part 31, Conformance testing methodology and framework: General concepts;

— Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;

— Part 33, Conformance testing methodology and framework: Structure and use of abstract test suites;

— Part 34, Conformance testing methodology and framework: Abstract test methods;

— Part 35, Conformance testing methodology and framework: Abstract test methods for SDAI implementations;

— Part 41, Integrated generic resource: Fundamentals of product description and support;

— Part 42, Integrated generic resource: Geometric and topological representation;

— Part 43, Integrated generic resource: Representation structures;

— Part 44, Integrated generic resource: Product structure configuration;

— Part 45, Integrated generic resource: Materials;

— Part 46, Integrated generic resource: Visual presentation;

— Part 47, Integrated generic resource: Shape variation tolerances;

— Part 49, Integrated generic resource: Process structure and properties;

— Part 101, Integrated application resource: Draughting;

— Part 104, Integrated application resource: Finite element analysis;

— Part 105, Integrated application resource: Kinematics;

— Part 106, Integrated application resource: Building construction core model;

— Part 201, Application protocol: Explicit draughting;

— Part 202, Application protocol: Associative draughting;

— Part 203, Application protocol: Configuration controlled design;

— Part 204, Application protocol: Mechanical design using boundary representation;

— Part 205, Application protocol: Mechanical design using surface representation;

— Part 207, Application protocol: Sheet metal die planning and design;

— Part 208, Application protocol: Life cycle management - Change process;

— Part 209, Application protocol: Composite and metallic structural analysis and related design;

— Part 210, Application protocol: Design of layered electronic products;

— Part 211, Application protocol: Electronics test diagnostics and remanufacture;

— Part 212, Application protocol: Electrotechnical design and installation;

— Part 213, Application protocol: Numerical control process plans for machined parts;

— Part 214, Application protocol: Core data for automotive mechanical design;

— Part 215, Application protocol: Ship arrangement;

— Part 216, Application protocol: Ship moulded forms;

— Part 217, Application protocol: Ship piping;

— Part 218, Application protocol: Ship structures;

— Part 220, Application protocol: Process planning, manufacture, and assembly of layered electronic products;

— Part 221, Application protocol: Functional data and their schematic representation for process plant;

— Part 222, Application protocol: Exchange of product data for composite structures;

— Part 223, Application protocol: Exchange of design and manufacturing product information for cast parts;

— Part 224, Application protocol: Mechanical product definition for process plans using mechanical feature;

— Part 225, Application protocol: Building elements using explicit shape representation;

— Part 226, Application protocol: Ship mechanical systems;

— Part 227, Application protocol: Plant spatial configuration;

— Part 228, Application protocol: Building services: Heating, ventilation, and air conditioning;

— Part 229, Application protocol: Exchange of design and manufacturing product information for forged parts;

— Part 230, Application protocol: Building structural frame: Steelwork;

— Part 231, Application protocol: Process engineering data: Process design and process specification of major equipment;

— Part 232, Application protocol: Technical data package;

— Part 301, Abstract test suite: Explicit draughting;

— Part 302, Abstract test suite: Associative draughting;

— Part 303, Abstract test suite: Configuration controlled design;

— Part 304, Abstract test suite: Mechanical design using boundary representation;

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— Part 501, Application interpreted construct: Edge-based wireframe;

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The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure.

— Parts 11 to 13 specify the description methods,

— Parts 21 to 26 specify the implementation methods,

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

— Parts 41 to 49 specify the integrated generic resources,

— Parts 101 to 106 specify the integrated application resources,

— Parts 201 to 232 specify the application protocols,

— Parts 301 to 332 specify the abstract test suites, and

— Parts 501 to 518 specify the application interpreted constructs.

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

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

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation 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 interpreted constructs, application protocols, 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 exchange of computer-interpretable technical drawings which are generated in a computer-aided design/draughting (CAD) system. These drawings consist of two-dimensional presentations of two-dimensional or three-dimensional geometry and planar annotation defined in a two-dimensional or three-dimensional coordinate space. This part provides the structures for the exchange of such drawings within and among organizations, especially those operating in the mechanical engineering and architectural, engineering, and construction (AEC) industrial sectors.

The exchange of such drawings provides a means of communicating product data during all stages of the life cycle of a product. This product data, in the form of a drawing, may be interpreted by people according to accepted international, national, or organization draughting standards. The use of drawings for the purposes of the communication of product data is common practice in many industries. This product data may also be interpreted by appropriate computer systems for use in applications other than draughting.

This application protocol makes use of four fundamental concepts that relate to the creation, revision, storage, and use of drawings produced using CAD systems. Drawings may include the following:

— representations of the shape of the product, or products, depicted by the drawing;

— information used in administering drawings for purposes of configuration control, audit trails, etc;

— representations of annotations implying suggested machining sequence;

— information on assembly, subassembly, component parts relationship.

The use of the shape representation depicted in the drawing depends on the interpretation of a draughtsman or engineer viewing the drawing. For this reason the concept of a draughting shape model

is included. A draughting shape model is a representation of the shape of a product whose interpretation is determined through visual inspection of the drawings that depict the product.

> EXAMPLE 1 - An architectural drawing may contain both isometric and perspective views of a building. The use of the two-dimensional representations depicted in these views depends on the knowledge, in the mind of a designer, that the lengths of lines may be measured or calculated in the isometric view but not in the perspective view.

This part of ISO 10303 is related to ISO 10303-201 [7], since both support the same basic application domain, draughting. Many of the requirements defined within both application protocols are the same. However, the requirements defined within two basic areas of this part of ISO 10303 have a broader scope. These two areas are the types of draughting shape models that drawings are generated from, and the associativity of annotation to geometric elements and other annotation within the draughting shape model or drawing.

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

The data planning model illustrates that a product is described by a draughting shape model. The draughting shape model is a two-dimensional or three-dimensional model generated by a CAD system. This CAD model is composed of geometry which represents the shape of the product and may also include annotation. The product is documented by a drawing.

The drawing is composed of drawing sheets that contain annotation and drawing views. The drawing views are two-dimensional views of the draughting shape model that may include additional annotation. Therefore, the drawing is a presentation of the draughting shape model.

Annotation, in the form of text and symbology, is composed of geometry and presented in the draughting shape model, the drawing views, or on the drawing sheets. Annotation provides additional product data that may be needed to fully define the product or interpret the drawing. This annotation may be associated to geometry or other annotation in the draughting shape model and drawing views. A description of this association is given in annex L.

Constraints on the dimensionality of data have been applied where currently limited by CAD technology. For instance, views of the draughting shape model and annotation applied to a drawing sheet are two-dimensional. All drawings that are produced in paper form are two-dimensional. Therefore, the corresponding electronic data consists of two-dimensional representations.

This application protocol defines the context, scope, and information requirements for exchange of drawings with associative annotation and specifies the integrated resources necessary to satisfy these requirements.

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