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

Part 5001: Guidance on the usage of ISO 10303-214 for gear units

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

ISO/TS 10303-5001 was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

Each part of ISO 10303 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, application modules and usage guidance.

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

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

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 a series of guidance documents for application protocols (APs). This part of ISO 10303 specifies guidance for gear mechanical design processes.

This guidance document defines the context, scope, and information requirements for various development phases during the design of a gear unit and specifies the ISO 10303-214 resources necessary to satisfy these requirements.

NOTE 1 ISO 10303-214 is an application protocol for automotive mechanical design processes. It might also be applicable to other forms of vehicles, such as rail, agricultural, and construction vehicles.

Clause 1 defines the scope of the usage guide and summarizes the functionality and data covered by the usage guide. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. 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 A.

This part of ISO 10303 is an optional addition to ISO 10303-214 that specifies requirements for the representation and exchange of product model data related to gear units using ISO 10303-214. This part of ISO 10303 contains a product model for gear units. This product model covers gear units with all their machine elements, tools for the manufacturing of gears, and properties that arise during the product development process of gear units. The properties can be assigned to machine elements, functional part relations or an entire gear unit. Only the mechanical aspects of gear units and their components are covered by this part of ISO 10303; electrical, electronic, hydraulic, and pneumatic aspects are not included.

While the product model for gear units contains some high-level concepts defined in ISO 10303-214, it is not an extension (through subtyping or some other formal means) of the ISO 10303-214 application reference model (ARM). The product model for gear units is a requirements model and is not intended to be implemented directly. Instead, the ISO 10303-214 ARM or application interpreted model (AIM) should be used. Clause 5 shows the correspondence between the information requirements specified in this part of ISO 10303 and the ISO 10303-214 ARM.

NOTE 2 ISO 10303-214 includes a mapping between the ISO 10303-214 ARM and AIM.

NOTE 3 Because the product model for gear units is mapped to the ISO 10303-214 ARM, the ISO 10303-214 ARM or AIM can be used, unchanged, to represent and exchange product model data related to gear units.

Annex A provides the product model for gear units. The product model is a graphical representation of the structure and constraints of the application objects presented in EXPRESS-G.

Annex B contains tables that show recommendations for properties of the product model for gear units.

Annex C describes the connection between the product model for gear units and ISO 10303-214 which consists of a mechanism that defines a data structure in ISO 10303-214 equivalent to the product model for gear units.

Annex D describes a divergent mapping mechanism for the application objects of the product model for gear units to explicit ARM constructs of ISO 10303-224.

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Industrial automation systems and integration — Product data representation and exchange — Part 5001: Guidance on the usage of ISO 10303-214 for gear units

1 Scope

This part of ISO 10303 specifies guidance on the usage of ISO 10303-214 application reference model (ARM) for the scope and information requirements for the exchange of information between the applications that support the development process of the mechanical aspects of gear units.

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

- parts related to gear units:
 - baseplate;
 - basic material;
 - belt;
 - bevel gear;
 - brake;
 - chain;
 - clutch;
 - coupling;
 - crossed helical gear;
 - fit of key assembly
 - fitting key;
 - helical gear;
 - housing;
 - hypoid gear;
 - interference fit assembly;
 - lubricant;
 - pinion shaft;
 - plain bearing;
 - planetary gear train;
 - rolling element bearing;
 - sealing;
 - shaft;
 - spur gear;

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- tool;
- user defined machine element;
- wheel;
- worm and worm wheel;
- basic materials used to produce those parts;
- lubricants for gear units;
- tools used for the manufacturing of gear units;
- gear technology properties that can be assigned to parts, assemblies, tools, lubricants and basic materials:
 - deformations, shift and bending;
 - dynamic;
 - efficiency loss;
 - environment;
 - forces and moments;
 - geometry, topology and geometry dependent data;
 - hardness;
 - life time;
 - load capacity data (wear, pitting, breakage, scuffing);
 - manufacturing data;
 - mesh data;
 - operating data;
 - power, rotation and speed;
 - pressure and stress;
 - safety;
 - service data;
 - sliding and wear;
 - stiffness, suspension;
 - surface texture;
 - temperature data.

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

- manufacturing of elements other than gears;
- items that are outside the scope of ISO 10303-214.

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

ISO 10303-214, *Industrial automation systems and integration — Product data representation and exchange — Part 214: Application protocol: Core data for automotive mechanical design processes*

3 Terms, definitions and abbreviated terms

3.1 Terms defined in ISO 10303-1

For the purposes of this document, the following terms defined in ISO 10303-1 apply:

- application;
- application activity model;
- application interpreted model;
- application protocol;
- assembly;
- conformance class;
- unit of functionality

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3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

AAM	application activity model
AIM	application interpreted model
AP	application protocol
CAD	Computer Aided Design
CSG	Constructive Solid Geometry
UoF	unit of functionality

4 Information requirements

4.1 Preliminary elements

For the purposes of this part of ISO 10303, the following ISO 10303-214 units of functionality apply:

- external_reference_mechanism (E1);
- item_property (PR1);
- product_management_data (S1);
- item_defined_structure (S3);
- process_plan (S8).

4.2 Application objects

This subclause specifies the application objects for the usage of ISO 10303-214 for gear units. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 Application_context

An Application_context is a shared universe of discourse.

NOTE The definition of this application object is exactly the same as of the application object of the same name in ISO 10303-214.

The data associated with an Application_context are the following:

- application_domain;
- life_cycle_stage.

4.2.1.1 application_domain

The application_domain specifies the identification of the applications for which an object might be relevant.

Where applicable the following values shall be used:

- 'assembly study': The object might be relevant for an assembly study;
- 'digital mock-up': The object might be relevant for digital mock-up;
- 'electrical design': The object might be relevant for the electrical design;
- 'mechanical design': The object might be relevant for the mechanical design;
- 'preliminary design': The object might be relevant for the preliminary design;

- 'process planning': The object might be relevant for the process planning.

4.2.1.2 life_cycle_stage

The `life_cycle_stage` specifies of the general stage in the product life cycle to which the concerned parts belong.

Where applicable the following values shall be used:

- 'design': The concerned part belongs to the design phase of the life cycle;
- 'manufacturing': The concerned part belongs to the manufacturing phase of the life cycle;
- 'recycling': The concerned part belongs to the recycling phase of the life cycle.

4.2.2 Application_property

An `Application_property` is a type of `Property` (see 4.2.77) that arises during operation of the gear unit.

NOTE The definition of this application object corresponds to the definition of the application object `General_property` of ISO 10303-214. The following restrictions/limitations to the definition of the application object of ISO 10303-214 have been made: The `property_type` attribute of the `General_property` object is instantiated with "application" to identify it as an application property.

An `Application_property` is a `Service_property` (see 4.2.83), a `Safety` (see 4.2.81), a `Life_time` (see 4.2.45), an `Efficiency_loss` (see 4.2.24), an `Environment` (see 4.2.25), a `Sliding_wear` (see 4.2.93), a `Temperature` (see 4.2.101), a `Pressure_stress` (see 4.2.76), a `Torque_force` (see 4.2.104), a `Power_rotation_speed` (see 4.2.75) or a `Deformation_shift_bending` (see 4.2.20).

4.2.3 Assembly_definition

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An `Assembly_definition` is a type of `Part_definition` (see 4.2.62) that is a definition of a `Part_version` (see 4.2.66) that contains other subordinate objects.

NOTE The definition of this application object is exactly the same as of the application object of the same name in ISO 10303-214.

The data associated with an `Assembly_definition` are the following:

- `assembly_type`

4.2.3.1 assembly_type

The `assembly_type` specifies the kind of the `Assembly_definition`.

EXAMPLE 'functional assembly', 'manufacturing assembly', and 'design assembly' are examples of an `assembly_type`.

The `assembly_type` need not be specified for a particular `Assembly_definition`.

4.2.4 Assembly_relationship

An `Assembly_relationship` is the relation between an `Assembly_definition` (see 4.2.3) and a `Part_definition` (see 4.2.62) representing a constituent of the assembly. The `Assembly_definition` and the `Part_definition` that serves as definition should share at least one `Application_context` (see 4.2.1).