

**Implementation of
ISO 10303-203 : 1994**

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

**Part 203. Application protocol:
Configuration controlled design**

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee AMT/4, Product data exchange, upon which the following bodies were represented:

British Aerospace
CIMIO Ltd.
Construction Industry Computing Association
Department of Trade and Industry (Services Management Division (IMS))
GKN Technology Limited
Institute of Materials
Institution of Chemical Engineers
Institution of Electrical Engineers
Lloyd's Register of Shipping
Ministry of Defence
NAFEMS
Nine Tiles Computer Systems Ltd.
Rutherford Appleton Laboratory (Services Management Division (IMS))
South Bank University
University of Bristol
University of Leeds Industrial Services Ltd.
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This British Standard, having been prepared under the direction of the Advanced Manufacturing Technology Assembly, was published under the authority of the Standards Board and comes into effect on 15 July 1996

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Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard

National foreword

This British Standard reproduces verbatim ISO 10303-203 : 1994, including Corrigendum No. 1, and implements it as the UK national standard.

Technical Corrigendum No. 1 to ISO 10303-203 applies only to the diskette supplied with this standard.

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- aid enquirers to understand the text;
- present to the responsible international committee any enquiries on interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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INTERNATIONAL
STANDARD

ISO
10303-203

First edition
1994-12-15

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

Part 203:

Application protocol: Configuration controlled
design

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

Partie 203: Protocole d'application: Conception contrôlée de configuration

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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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 10303-203 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data and global manufacturing languages*.

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 methods: The EXPRESS language reference manual;
- Part 21, Implementation methods: Clear text encoding of the exchange structure;
- Part 22, Implementation methods: Standard data access interface;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- Part 41, Integrated generic resources: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resources: Representation structures;
- Part 44, Integrated generic resources: Product structure configuration;
- Part 45, Integrated generic resources: Materials;

- Part 46, Integrated generic resources: Visual presentation;
- Part 47, Integrated generic resources: Shape variation tolerances;
- Part 49, Integrated generic resources: Process structure and properties;
- Part 101, Integrated application resources: Draughting;
- Part 104, Integrated application resources: Finite element analysis;
- Part 105, Integrated application resources: Kinematics;
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 210, Application protocol: Printed circuit assembly product design data;
- Part 213, Application protocol: Numerical control process plans for machined parts.

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

- Part 11 specifies the description methods;
- Parts 21 and 22 specify the implementation methods;
- Parts 31 and 32 specify the conformance testing methodology and framework;
- Parts 41 to 49 specify the integrated generic resources;
- Parts 101 to 105 specify the integrated application resources;
- Parts 201 to 213 specify the application protocols.

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

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

Diskette

Users should note that this part of ISO 10303 comprises a diskette:

- the short names of entities given in annex B are also included on the diskette;
- the EXPRESS listings (annex A) are provided on the diskette only;
- a method to enable users to report errors in the documentation is given. Full details are provided in the file.

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 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 use of product data within a defined context which satisfies an industrial need to exchange configuration-controlled 3D product design data of mechanical parts and assemblies. In order to specify the composition of products, organizations use many computer-based application systems. Integral to the definition of a product are the specification of its shape, the specification of its configurations and the applicability of its possibly multiple definitions to a particular configuration. This data may reside on one or more application systems within an organization. The integration of the data that defines the shape of a product with the data concerning its configuration is essential to an organization's ability to define its products without relying on redundant data in disparate application systems. In order for the definition of the design of products to be communicated, an organization must be able to share its product data with partners, vendors, and customers.

This application protocol defines the exchange of product definitions with three-dimensional shape representations and the data which defines and controls the configuration of those product definitions. This application protocol is concerned solely with the design phase of the product life cycle. Only the designs of mechanical parts and assemblies may be exchanged using this specification. The specification of the 3D shape of a mechanical part or assembly in this application protocol may be made by any of five different types of geometric representation.

Although important to the design of the product, the product's shape is not of primary focus in this application protocol. The primary focus of this specification is the data which controls the tracking and management of the product. This data includes the following:

- identification of a product to an organization's customers and the link of the design identification of the components which comprise the product;
- the documentation of formal change and release of designs for the product;
- the history of the development of the product as it goes through the formal initiation, change and release process;

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- the structure of the relationship of each of the components of the product to the whole;
- additional information concerning materials, processes, finishes and other design requirements about the product;
- the identification of qualified suppliers for the product or the design of the product.

This application protocol defines the context, scope, and information requirements for the exchange of configuration-controlled 3D designs of mechanical parts and assemblies 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.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. 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 D.

**Industrial automation systems and integration -
Product data representation and exchange -
Part 203:
Application protocol: Configuration controlled 3D designs
of mechanical parts and assemblies**

1 Scope

This part of ISO 10303 specifies the integrated resources necessary for the scope and information requirements for the exchange between application systems of configuration-controlled 3D designs of mechanical parts and assemblies. Configuration in this context only includes data and processes that control the 3D product design data. Exchange is used as a scoping consideration to narrow the scope to only those data which are exchanged as part of the 3D product definition. Organizations exchanging data within the scope of this part of ISO 10303 may have a contractual relationship, the details of which are outside the scope of this part.

NOTE - The application activity model in annex E 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:

- a) Products that are mechanical parts and assemblies;
- b) Product definition data and configuration control data pertaining to the design phase of a product's development;
- c) The change of a design and data related to the documentation of the change process;
- d) Five types of shape representations of a part that include wireframe and surface without topology, wireframe geometry with topology, manifold surfaces with topology, faceted boundary representation, and boundary representation;
- e) Alternate representations of the data by different disciplines during the design phase of a product's life cycle;
- f) Identification of government, industry, company or other specifications for design, process, surface finish, and materials which are specified by a designer as being applicable to the design of the product;

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- g) The identification of government, industry, company, or other standard parts for the purpose of their inclusion in a product's design;
- h) Data that are necessary for the tracking of a design's release;
- i) Data that are necessary to track the approval of a design, a design aspect, or a configuration control aspect of a product;
- j) Data that identify the supplier of either the product or the design and, where required by an organization, qualification information for the supplier;
- k) If a part is being designed under a contract, the identification of, and reference to, that contract under which a design is developed;
- l) The identification of the security classification of a single part or a part when it is a component in an assembly;
- m) Data that is used in, or results from, the analysis or test of a design which is used as evidence for consideration of a change to a design.

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

- a) Data that is used in, or results from, the analysis or test of a design that is not used as evidence for consideration of a change to a design;
- b) Data that results in changes to the design during the initial design evolution prior to its release;
- c) Product definition data and configuration control data pertaining to any life cycle phase of a product's development other than design;
- d) The business data for the management of a design project;
- e) Alternate representations of the data by different disciplines outside of the design phase (e.g., manufacturing);
- f) The use of constructive solid geometry for the representation of objects;
- g) Data that pertains to the visual presentation of any of the shape or configuration control data.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

ISO 31:1992, *Quantities and units*.

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*.

ISO/IEC 8824-1:¹⁾, *Information technology - Open systems interconnection - Abstract syntax notation one (ASN.1) - Part 1: Specification of basic notation*.

ISO 10303-1:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 11: Description methods: The EXPRESS language reference manual*.

ISO 10303-21:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 21: Clear text encoding of the exchange structure*.

ISO 10303-31:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 31: Conformance testing methodology and framework: General concepts*.

ISO 10303-41:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 41: Integrated generic resources: Fundamentals of product description and support*.

ISO 10303-42:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 42: Integrated generic resources: Geometric and topological representation*.

ISO 10303-43:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 43: Integrated generic resources: Representation structures*.

ISO 10303-44:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 44: Integrated generic resources: Product structure configuration*.

¹⁾To be published.

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3 Definitions and abbreviations

For the purposes of this part of ISO 10303, the following definitions and abbreviations apply.

3.1 Terms defined in ISO 10303-1

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1.

- abstract test suite;
- application;
- application activity model;
- application context;
- application interpreted model;
- application object;
- application protocol;
- application reference model;
- assembly;
- component;
- conformance class;
- conformance requirement;
- data;
- data exchange;
- implementation method;
- information;
- integrated resource;
- interpretation;

- PICS proforma;
- product;
- product data;
- protocol implementation conformance statement;
- structure;
- unit of functionality.

3.2 Terms defined in ISO 10303-31

This part of ISO 10303 makes use of the following terms defined in ISO 10303-31.

- conformance testing;
- preprocessor;
- postprocessor;

3.3 Terms defined in ISO 10303-42

This part of ISO 10303 makes use of the following terms defined in ISO 10303-42.

- arcwise connected;
- axi-symmetric;
- bounds;
- boundary;
- boundary representation solid model;
- closed curve;
- closed surface;
- connected;
- connected component;

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- curve;
- cycle;
- dimensionality;
- domain;
- extent;
- finite;
- geometric coordinate system;
- graph;
- handle;
- homomorphic;
- list;
- d -manifold with boundary;
- open curve;
- open surface;
- orientable;
- overlap;
- parameter range;
- parameter space;
- placement coordinate system;
- self-intersect;
- self-loop;
- set;

- space dimensionality;
- surface;
- topological sense.

3.4 Terms defined in ISO 10303-43

This part of ISO 10303 makes use of the following terms defined in ISO 10303-43.

- coordinate space;
- geometrically founded;
- geometrically related.

3.5 Terms defined in ISO 10303-44

This part of ISO 10303 makes use of the following terms defined in ISO 10303-44.

- ancestor node;
- bill-of-material structure;
- child node;
- directed acyclic graph;
- descendent node;
- form, fit and function of a product;
- leaf node;
- link;
- lot;
- node;
- parent node;
- parts list structure;

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- promissory use;
- root node.

3.6 Other definitions

For the purpose of this part of ISO 10303, the following definitions apply.

3.6.1 boundary representation model: a solid model represented by the set of shells defining their exterior or interior boundaries. Constraints ensure that the associated geometry is well defined and that the Euler formula connecting the numbers of vertices, edges, faces, loops and shells in the model is satisfied.

3.6.2 design phase: the period during which the engineering representation of a product is dynamic.

3.6.3 mechanical part: a physical object which can be formed from material into a static shape.

3.6.4 solid model: a three dimensional object with a well defined inside and outside separated by a two dimensional boundary.

3.6.5 sub-assembly: a constituent that is an assembly.

3.6.6 wireframe model: a model that consists entirely of points, lines, and curves whose edges represent a shape.

3.7 Abbreviations

For the purposes of this part of ISO 10303, the following abbreviations apply.

AAM	application activity model
AIM	application interpreted model
AP	application protocol
ARM	application reference model
BOM	bill-of-material
CAD	computer aided design
CM	configuration management
DAG	directed acyclic graph

ICAM	integrated computer-aided manufacturing
ID	identification
IDEF0	ICAM definition language 0
IDEF1X	ICAM definition language 1 - extended
PICS	Protocol information and conformance statement
UoF	Units of Functionality

4 Information requirements

This clause specifies the information requirements for the exchange of configuration-controlled 3D designs of mechanical parts and assemblies.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTES

- 1 - A graphical representation of the information requirements is given in annex G.
- 2 - The information requirements correspond to those of the activities identified as being in the scope of this application protocol in annex F.
- 3 - The mapping table is specified in 5.1 which shows how the information requirements are met using the integrated resources of this International Standard. The use of the integrated resources introduces additional requirements which are common to application protocols.

4.1 Units of functionality

This subclause specifies the units of functionality (UoF) for the configuration-controlled 3D designs of mechanical parts and assemblies application protocol. This part of ISO 10303 specifies the following units of functionality:

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- advanced_boundary_representation;
- authorization;
- bill_of_material;
- design_activity_control;
- design_information;
- effectivity;
- end_item_identification;
- facetted_boundary_representation;
- manifold_surface_with_topology;
- non_topological_surface_and_wireframe;
- part_identification;
- shape;
- source_control;
- wireframe_with_topology.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in clause 4.2.

4.1.1 advanced_boundary_representation

The advanced_boundary_representation UoF contains the representation of the of a part using advanced boundary representation solid models. This representation allows for the definition of curves and surfaces and the topology that bounds them. Boundaries are explicitly defined only by topology. All of the geometry that defines the part's shape shall be associated with topology.

The following application object is used by the advanced_boundary_representation UoF:

- Advanced_B_rep.

4.1.2 authorization

The authorization UoF contains the constructs to indicate the acceptance of a piece of product data, on a specific date, at a particular level of status, by a group of people having roles that allow them to grant the authorization.

The following application objects are used by the authorization UoF:

- Approval;
- Person_organization.

4.1.3 bill_of_material

The bill_of_material UoF contains the objects necessary to represent the structured list of materials or components required to build a part.

The following application objects are used by the bill_of_material UoF:

- Alternate_part;
- Component_assembly_position;
- Engineering_assembly;
- Engineering_make_from;
- Engineering_next_higher_assembly;
- Engineering_promissory_usage;
- Substitute_part.

4.1.4 design_activity_control

The design_activity_control UoF contains the information which describes the history of part versions. It identifies initial part design requirements as well as the change requirements for revised part versions. It provides the directive for work to proceed in the development of these initial or modified part versions.

The following application objects are used by the design_activity_control UoF:

- Change_order;

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- Change_request;
- Start_order;
- Start_request;
- Work_order;
- Work_request.

4.1.5 design_information

The design_information UoF contains a collection of information about a part, separate from the part identification and shape information, that defines specific qualities the completed part shall possess. This information identifies specifications related to the design and manufacture of the part and constraints on the application of those specifications.

The following application objects are used by the design_information UoF:

- Additional_design_information;
- Design_specification;
- Material_specification;
- Process_specification;
- Specification;
- Surface_finish_specification;
- Usage_constraint.

4.1.6 effectivity

The effectivity UoF contains information about the planned usage of components in a product model.

The following application objects are used by the effectivity UoF:

- Planned_date_effectivity;
- Planned_effectivity;

- Planned_lot_effectivity;
- Planned_sequence_effectivity.

4.1.7 end_item_identification

The end_item_identification UoF contains information about the different products that are sold by an organization to its customers. It provides the information structures for an organization to control the configuration of these products.

The following application objects are used by the end_item_identification UoF:

- Product_configuration;
- Product_model.

4.1.8 faceted_boundary_representation

The faceted_boundary_representation UoF contains the representation of the shape of a part where planar surfaces are the bounding surfaces for the solid model. Only points and planar polygons are used in this representation. Much of the topological information is implicit for this representation.

The following application object is used by the faceted_boundary_representation UoF:

- Faceted_B_rep.

4.1.9 manifold_surface_with_topology

The manifold_surface_with_topology UoF contains the representation of the shape of a part using manifold surfaces with topology. The outer boundary of the part is defined by 3D curves, surfaces and topology.

The following application object is used by the manifold_surface_with_topology UoF:

- Manifold_surface_with_topology.

4.1.10 non_topological_surface_and_wireframe

The non_topological_surface_and_wireframe UoF contains the representation of the shape of a part using surface or wireframe geometry without topology. These representations are formed only by the use of points, curves and surfaces. The boundaries of the curves are defined explicitly by points on the curves and by explicit associations between the points and the curves they bound. The boundaries of the surfaces are defined by curves on the surfaces and by explicit associations between

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the curves and the surfaces they bound. Surfaces and curves shall be explicitly trimmed unless they are closed.

The following application object is used by the `non_topological_surface_and_wireframe` UoF:

- `Non_topological_surface_and_wireframe`.

4.1.11 part_identification

The `part_identification` UoF contains the structure through which a part, unique versions of a part, and different design discipline views of a part can be defined.

The following application objects are used by the `part_identification` UoF:

- `Design_discipline_product_definition`;
- `Part`;
- `Part_version`.

4.1.12 shape

The `shape` UoF contains the geometric and topological definition of a part. This UoF permits different types of geometric representation for each portion of the shape of the part. These portions, when taken together, form the entire shape of the part.

The following application objects are used by the `shape` UoF:

- `Geometric_model_representation`;
- `Shape`;
- `Shape_aspect`.

4.1.13 source_control

The `source_control` UoF contains the information about an organization that is qualified to produce a particular part.

The following application objects are used by the `source_control` UoF:

- `Supplier`;
- `Supplied_part_version`.

4.1.14 wireframe_with_topology

The wireframe_with_topology UoF contains the representation of the shape of a part by wireframes that are defined by edge topology. This includes 3D curves and topology.

The following application object is used by the wireframe_with_topology UoF:

— Wireframe_with_topology.

4.2 Application objects

This subclause specifies the application objects for the configuration-controlled 3D designs of mechanical parts and assemblies application protocol. 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 Additional_design_information

An Additional_design_information is a collection of specifications that are associated with the design of a part.

EXAMPLE 1 - The concepts of transmissivity, absorptivity, and reflectivity are additional design information in the form of product requirements which can be made known to downstream processes such as manufacturing and testing by a specification reference with a usage constraint related to the part.

4.2.2 Advanced_B_rep

An Advanced_B_rep is a type of Geometric_model_representation (see 4.2.15) that represents the shape of a part or an aspect of the shape of a part by an advanced boundary representation solid model. This representation allows for the definition of curves and surfaces and for the topology that bounds them. Boundaries are explicitly defined only by topology. All of the geometry that defines the part's shape or an aspect of the part's shape shall be associated with topology.

4.2.3 Alternate_part

An Alternate_part is a part that is interchangeable with another part with respect to form, fit, and function.

NOTE - The usages of an alternate part are not of interest to an organization that owns it and therefore are not tracked by that organization.

EXAMPLE 2 - A design requires a sheet metal screw of a certain size. Sheet metal screws are made by various organizations and are equivalent with respect to form, fit, and function for that size. The various

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screws have different part numbers assigned to them by the manufacturer. The design organization does not track which screw is used in the actual assembly. These screws are alternate parts.

4.2.4 Approval

An Approval is an indication within an organization of concurrence or nonconcurrence with a piece of product data. The data associated with an Approval are the following:

- date;
- purpose;
- status.

4.2.4.1 date

The date specifies when the approval became, or will become, effective.

4.2.4.2 purpose

The purpose specifies the reason for the approval.

4.2.4.3 status

The status specifies the state of consent applied to a piece of product data or a relationship between pieces of product data. Valid values for the status of an approval are: approved and not approved. Approved means the required concurrence has been established. Not approved means the required concurrence has not been established.

4.2.5 Change_order

A Change_order is a type of Work_order (see 4.2.40) that authorizes the development of a modified design of a part that results in the establishment of a new part version. The data associated with a change_order are the following:

- adopted_solution;
- change_date.

4.2.5.1 adopted_solution

The adopted_solution specifies the solution selected from the set of recommended solutions for a Change_request (see 4.2.6).

4.2.5.2 change_date

The change_date specifies the date when the Change_order became effective.

4.2.6 Change_request

A Change_request is a type of Work_request (see 4.2.40) that identifies the proposed extent of work to be done to modify the design of a part. The data associated with a change_request are the following:

- consequence;
- recommended_solution;
- version.

4.2.6.1 consequence

The consequence specifies the effects in performance, functionality, or form of a particular recommended solution on the affected part version. There may be more than one consequence for a Change_request.

EXAMPLE 3 - A change to a design might be to thicken a support on the wing of an aircraft. The consequence of the additional thickness would be that the wing will now support x amount of additional load and the aircraft would be carrying y amount of additional weight.

4.2.6.2 recommended_solution

The recommended_solution specifies a potential resolution that would satisfy the requirements described in the change request through the Work_request description (see 4.2.41). There may be more than one recommended_solution for a Change_request.

4.2.6.3 version

The version specifies a unique identifier for each iteration of a change request.

4.2.7 Component_assembly_position

A Component_assembly_position is the identification of the position of the component in the assembly. The data associated with a Component_assembly_position is the following:

- transformation.

4.2.7.1 transformation

The transformation specifies the translation and orientation of the component in the geometric space of the assembly.

4.2.8 Design_discipline_product_definition

A Design_discipline_product_definition is one of the organizational definitions or views of a Part_version (see 4.2.20). The data associated with a Design_discipline_product_definition are the following:

- CAD_filename;
- creation_date;
- description;
- discipline_id.

NOTE - This entity may be used to capture the definition of a particular Part_version at any intermediate stage of its development where the definition is not yet formally tracked by an organization at the Part_version level. It may be used to capture the various stages in the definition cycle of a product.

EXAMPLE 4 - Stages in the definition cycle may be a bill of material view, a finite element model view, a functional system view, or a manufacturing view.

4.2.8.1 CAD_filename

The CAD_filename specifies the name of the file that contains the geometric part description in a computer aided design system. The CAD_filename need not be specified for a particular Design_discipline_product_definition. If this name is provided, the file is assumed to contain an external definition of the shape of the part that is meaningful only within the organization that designed the part.

4.2.8.2 creation_date

The creation_date specifies the date and time that the Design_discipline_product_definition was first defined.

4.2.8.3 description

The description specifies the purpose for a particular definition of the product.

4.2.8.4 discipline_id

The discipline_id specifies the view or stage to which the definition of the product pertains.

4.2.9 Design_specification

A Design_specification is a type of Specification (see 4.2.31) that sets the design requirements of parts. These requirements are not determined by other design or construction features or referenced data.

EXAMPLE 5 - The requirements set forth in a Design_specification might be weight limits, dimensional limits, reflectivity, color, transparency, feel, and appearance.

4.2.10 Engineering_assembly

An Engineering_assembly is the parent-child relationship between an assembly and a component or sub-assembly. Each Engineering_assembly may be one of the following: an Engineering_next_higher_assembly (see 4.2.12), or an Engineering_promissory_usage (see 4.2.13). The data associated with an Engineering_assembly are the following:

- security_code.

NOTE - The scope of this part of ISO 10303 is limited to the exchange of product design definition bill of materials. It does not cover all bills of material required by an organization.

4.2.10.1 security_code

The security_code specifies the security classification of a component in an assembly.

NOTE - This differs from the attribute security_code associated with Part_version (see 4.2.20) in that some aspect of the component as it relates to an assembly changes its security classification when that part exists as the component within the assembly to which this security code is related. The part may have a security code when it exists alone that is independent of its use in any particular assembly. The security code specified here, however, defines the security code of the part in this very specific context.

EXAMPLE 6 - A wheel may be used in the production of a number of automobiles and its security classification is unclassified. That same wheel is used in an assembly that is then used in an experimental, highly sensitive, new automobile that is under development. Although the wheel itself is unclassified, the assembly that is in the new automobile is classified as top secret and the fact that this particular wheel is in the assembly also needs to be classified as top secret. This attribute then redefines the security classification of the wheel to be top secret when it is used as a component in the assembly for this particular automobile under development.

4.2.11 Engineering_make_from

An **Engineering_make_from** is the relationship between two parts in which one part is used as the basis for the design of the other part. This relationship is established by design so that it may be tracked through the life cycle of the product.

EXAMPLE 7 - Company A designs an assembly using a cup holder from company B but adds two additional mounting holes to company B's design. In this case, company A identifies the cup holder designed by company B as an **Engineering_make_from** part.

4.2.12 Engineering_next_higher_assembly

An **Engineering_next_higher_assembly** is a type of **Engineering_assembly** (see 4.2.10). It is the relationship of a part to its immediate parent within an assembly hierarchy. The data associated with an **Engineering_next_higher_assembly** are the following:

- **as_required**;
- **component_quantity**;
- **reference_designator**;
- **unit_of_measure**.

4.2.12.1 as_required

The **as_required** specifies whether the component quantity is explicitly defined or is to be quantified as needed in a particular usage.

EXAMPLE 8 - If the amount of sheet metal that is to be consumed in making a part is to be identified, one roll might be specified, where one is the quantity and roll is the unit of measure. Rolls of sheet metal might also be used as required. In this case, as required is the quantity and roll is again the unit of measure.

4.2.12.2 component_quantity

The **component_quantity** specifies the count of a component part found in an immediately higher assembly if **as_required** is false.

4.2.12.3 reference_designator

The `reference_designator` specifies a unique identifier that distinguishes a particular instance of a component in an assembly where more than one of a particular component part is used in an assembly.

EXAMPLE 9 - If four identical wheels are used in a car assembly then the `reference_designator` distinguishes the left-front wheel, for example, from the others.

4.2.12.4 unit_of_measure

The `unit_of_measure` specifies the fixed quantity in terms of which the `component_quantity` is expressed.

4.2.13 Engineering_promissory_usage

An `Engineering_promissory_usage` is a type of `Engineering_assembly` (see 4.2.10). It is the relationship of a part to a higher assembly where the next higher assembly of the part has not been defined.

EXAMPLE 10 - A number of brackets are needed in order to support a beam structure in the fuselage of an aircraft. A designer is designing one of the brackets and needs to specify its intended use in the product structure. The designer does not yet know the next higher assembly since the beam to which the bracket is to be attached is not yet defined in the product structure. The designer does, however, know the fuselage in which the bracket is used. Using this object, the designer can specify that the bracket is promised within a sub-assembly in support of the fuselage.

4.2.14 Faceted_B_rep

A `Facetted_B_rep` is a type of `Geometric_model_representation` (see 4.2.15) that represents the shape of a part or an aspect of the shape of a part by a faceted boundary representation solid model. This representation allows for the definition of shapes represented by planar surfaces as the bounding surfaces. Only points and planar polygons are used in this representation. Much of the topology information is implicit for this representation. Shells consist of faces bounded exclusively by polygons.

4.2.15 Geometric_model_representation

A `Geometric_model_representation` is the definition of the shape or a portion of the shape of a part. Each `Geometric_model_representation` may be one of the following: an `Advanced_B_Rep` (see 4.2.2), a `Faceted_B_rep` (see 4.2.14), a `Non_topological_surface_and_wireframe` (see 4.2.18), a `Manifold_surface_with_topology` (see 4.2.16), or a `Wireframe_with_topology` (see 4.2.39).

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4.2.16 Manifold_surface_with_topology

A **Manifold_surface_with_topology** is a type of **Geometric_model_representation** (see 4.2.15) that represents the shape of a part or an aspect of the shape of a part using manifold surfaces with topology. 3D curves, surfaces, and topology are used to define the outer boundary of the part.

4.2.17 Material_specification

A **Material_specification** is a type of **Specification** (see 4.2.31) that specifies properties that are applicable to raw material, mixtures, or semi-fabricated material that are used in the fabrication of a product.

4.2.18 Non_topological_surface_and_wireframe

A **Non_topological_surface_and_wireframe** is a type of **Geometric_model_representation** (see 4.2.15) that represents the shape or portions of the shape of a part using surface or wireframe geometry without topology. These representations are formed by the use of points, curves and surfaces only. The boundaries of the curves are defined explicitly by points on the curves and explicit associations between the points and the curves that they bound. The boundaries of the surfaces are defined by curves on the surfaces and explicit associations between the curves and the surfaces that they bound. Surfaces and curves must be explicitly trimmed unless they are closed.

4.2.19 Part

A **Part** is an item that is intended to be produced or employed in a production process. The data associated with a **Part** are the following:

- **part_classification**;
- **part_nomenclature**;
- **part_number**;
- **part_type**;
- **standard_part_indicator**.

4.2.19.1 part_classification

The **part_classification** specifies a family of related parts that have common processes applied to them during manufacturing. The **part_classification** need not be specified for a particular **Part**.

EXAMPLE 11 - Machined, punched, or turned parts may be categorized into separate part classes.

4.2.19.2 part_nomenclature

The `part_nomenclature` specifies a name by which the part is commonly known within an organization.

NOTE - The name can also have meaning outside of any single organization. For example, a single nation or industry can have naming conventions for different kinds of common parts.

4.2.19.3 part_number

The `part_number` specifies the unique identification of a part for a particular organization.

4.2.19.4 part_type

The `part_type` specifies one of a set of kinds of parts. The kinds of parts identified for this part of ISO 10303 are: detail, assembly, customer supplied material, or inseparable assembly. A part whose `part_type` value is detail is a part that exists at the lowest level of the bill of material. A part whose `part_type` value is assembly is a part that consists of a collection of other parts that are put together in order to satisfy a particular function. A part whose `part_type` value is government is a part that has been furnished to the design from a governmental source. A part whose `part_type` value is inseparable assembly is an assembly that after assembly cannot be dis-assembled without causing physical harm to at least one of the components of the assembly.

4.2.19.5 standard_part_indicator

The `standard_part_indicator` specifies whether or not a part has a design specified externally to the bill of material in which an assembly is being defined.

NOTE - A part may be a standard part for a company, industry, or other organization.

4.2.20 Part_version

A `Part_version` is the identification of the representation a part after its design has undergone a formal release or change. Only changes that are formally tracked by the organization that is responsible for the definition of the part shall result in a new instance of this application object. Iterations on designs that are not formally tracked by the organization responsible for the definition of the part shall not result in a new instance of this application object, but shall be tracked by the `Design_discipline_product_definition` application object. The data associated with a `Part_version` are the following:

- `contract_number`;
- `make_or_buy_code`;
- `release_status`;

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- revision_letter;
- security_code.

4.2.20.1 contract_number

The `contract_number` specifies the business contract under which the part was designed. The `contract_number` need not be specified for a particular `Part_version`. If the design was developed under a contract, this attribute shall specify the unique identification of that contract.

4.2.20.2 make_or_buy_code

The `make_or_buy_code` specifies the design organization's plan for obtaining the part. It will always be one of the two values `make` or `buy`. If the value of this attribute is `make`, the design organization has planned to make the part internally. If the value of the attribute is `buy`, the design organization plans for the part to be purchased from a vendor.

4.2.20.3 release_status

The `release_status` specifies the status of the version of a part with respect to the dissemination of design information. It will always be one of two values: `released` or `unreleased`. `Released` are those versions that have been reviewed and approved for further use. `Unreleased` are those versions that have been neither reviewed nor approved for further use.

4.2.20.4 revision_letter

The `revision_letter` specifies the unique identification of a particular version of a part.

4.2.20.5 security_code

The `security_code` specifies the security classification of a particular version of a part.

4.2.21 Person_organization

A `Person_organization` is the identification of an individual and the particular organization within which the individual plays a role. The data associated with a `Person_organization` are the following:

- address;
- organization;
- person.
- person_organization_id

4.2.21.1 address

The address specifies the routing for paper and/or electronic mail and, in some instances, physical location of a person and organization. The address need not be specified for a particular Person_ - organization.

4.2.21.2 organization

The organization specifies a collection of people grouped together for one or more common purposes.

4.2.21.3 person

The person specifies an individual human being.

4.2.21.4 person_organization_id

The person_organization_id specifies the unique identification of the Person_organization.

4.2.22 Planned_date_effectivity

A Planned_date_effectivity is a type of Planned_effectivity (see 4.2.23). It is the specification by the design organization of the expected usage of a part in a Product_configuration. The expected usage of the part within the product configuration is determined by one or two associated dates. The data associated with a Planned_date_effectivity are the following:

- end_date;
- start_date.

4.2.22.1 end_date

The end_date specifies the last date on which the part is planned by a design organization to be used in the Product_configuration. The end_date need not be specified for a particular Planned_date_effectivity. No end_date at the time of exchange signifies that an end_date has not yet been identified.

4.2.22.2 start_date

The start_date specifies the first date on which the part is to be used in the Product_configuration.

4.2.23 Planned_effectivity

A **Planned_effectivity** is the intended use of a part in a particular configuration of a product. Each **Planned_effectivity** is either a **Planned_date_effectivity** (see 4.2.22), **Planned_lot_effectivity** (see 4.2.24), or a **Planned_sequence_effectivity** (see 4.2.25).

4.2.24 Planned_lot_effectivity

A **Planned_lot_effectivity** is a type of **Planned_effectivity** (see 4.2.23). It is the specification of the use of a part in a **Product_configuration** where the part is produced as one of a group. Lots are used when parts are produced in batches and/or when important characteristics might vary between production runs. The data associated with a **Planned_lot_effectivity** are the following:

- **lot_number**;
- **lot_size**;
- **lot_size_unit_of_measure**.

4.2.24.1 lot_number

The **lot_number** specifies the identification of the group of parts that compose a lot.

4.2.24.2 lot_size

The **lot_size** specifies the quantity of parts within the lot.

4.2.24.3 lot_size_unit_of_measure

The **lot_size_unit_of_measure** specifies the fixed quantity amount in terms of which the **lot_size** is expressed.

4.2.25 Planned_sequence_effectivity

A **Planned_sequence_effectivity** is a type of **Planned_effectivity** (see 4.2.23). It is the specification of the intended use by a design organization of a part within a range of **Product_configurations** identified by planned serial numbers. The data associated with a **Planned_sequence_effectivity** are the following:

- **component_quantity**;
- **from_effectivity_id**;
- **quantity_unit_of_measure**;

— thru_effectivity_id.

4.2.25.1 component_quantity

The component_quantity specifies the number of units that are effective for a particular part in a configuration.

4.2.25.2 from_effectivity_id

The from_effectivity_id specifies the beginning planned serial number of the range for the Planned_sequence_effectivity.

4.2.25.3 quantity_unit_of_measure

This quantity_unit_of_measure specifies the measure in terms of which the component_quantity is expressed.

EXAMPLE 12 - Quantity_unit_of_measure may be rolls, sheets, or bars, among other things.

4.2.25.4 thru_effectivity_id

The thru_effectivity_id specifies the ending planned serial number of the range for the Planned_sequence_effectivity. The thru_effectivity_id need not be specified for a particular Planned_sequence_effectivity.

4.2.26 Process_specification

A Process_specification is a type of Specification (see 4.2.31) that is the identification of a service to be performed on a product or material.

EXAMPLE 13 - Typical processes are heat treatment, welding, plating, packing, and marking.

4.2.27 Product_configuration

A Product_configuration is a variation of a Product_model (see 4.2.28, 4.2.28.1). Configuration management is based on this application object. The data associated with a Product_configuration are the following:

- item_id;
- phase_of_product.

EXAMPLE 14 - A Product_configuration for the F14 military aircraft is the D configuration of the F14. The organization has defined four configurations of the F14, A,B,C and D. D, in this instance, is the

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configuration. A single product model might have many different configurations in order for the organization to identify different variations of it.

4.2.27.1 item_id

The item_id specifies the unique identification of a variation of the a Product_model.

4.2.27.2 phase_of_product

The phase_of_product specifies the stage in the life cycle of the product in which a particular version of the design is being exchanged.

EXAMPLE 15 - Within an organization four phases of a product may be Technology and Concept Development, Development and Refinement, Manufacturing and Assembly Validation, and Production.

4.2.28 Product_model

A Product_model is the product that the organization provides to its customers. The Product_model is identified for planning purposes in the design stage of a product. The data associated with a Product_model is the following:

— model_name.

4.2.28.1 model_name

The model_name specifies the unique identification assigned by an organization to a product that the organization provides to its customers.

EXAMPLE 16 - F14 is the identification of a Product_model that is a military aircraft.

4.2.29 Shape

A Shape is the mathematical representation of the form of a part.

4.2.30 Shape_aspect

A Shape_aspect is a distinct portion of the shape of a part. The shape of a part consists of one or many Shape_aspects.

NOTE - Often in design a number of different types of geometric models will define the shape of a single part depending on the complexity of the shape of the part in different physical areas. Each of these physical areas may be identified as a Shape_aspect.

4.2.31 Specification

A Specification is a document that contains definitions, processes, or rules related to a unique quality that an in-process or finished part shall possess. Each Specification is either a Design_specification (see 4.2.9), a Material_specification (see 4.2.17), a Process_specification (see 4.2.26), or a Surface_finish_specification (see 4.2.37). The data associated with a Specification are the following:

- specification_code;
- specification_source.

EXAMPLE 17 - Material, surface finish, and process specification are all examples of things that can be described implicitly by reference to other documents, rather than explicitly each time they are used.

4.2.31.1 specification_code

The specification_code specifies a unique identification of a Specification. The code is unique within the source organization.

4.2.31.2 specification_source

The specification_source specifies the organization that is responsible for the Specification.

4.2.32 Start_order

A Start_order is a type of Work_order (see 4.2.40) that authorizes work in the development of the initial design of a part, resulting in the creation of an original part version.

4.2.33 Start_request

A Start_request is a type of Work_request (see 4.2.41) that identifies the work to be done to initiate the design of a part.

4.2.34 Substitute_part

A Substitute_part is a component within an assembly whose form, fit, and function might be different from the component for which it is a replacement, but that can fulfill the requirements of another part within the context of the assembly.

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NOTES

- 1 - A substitute part is not required to have the same shape or quantity as the original part.
- 2 - This application object also may be used to eliminate version roll-up, i.e., the re-identification of all higher level assemblies when a new version of a lower level component is created.
- 3 - This application object allows one-way substitution only. Within a given context, if A is a substitute for B, then B is not to be assumed a substitute for A, unless explicitly stated so in another instance of this entity. If A is a substitute for B within context C, then either A or B may be used within an eventually built unit for C, but not both.

EXAMPLE 18 - A gauge of 120 psi $\pm$ 12 psi may be substituted by a gauge of 125 psi $\pm$ 6.25 psi, provided the increments are equal and the input and output sizes as well as the commodity it measures are the same.

4.2.35 Supplied_part_version

A Supplied_part_version is a part that is defined by its part number and its supplier. The data associated with a Supplied_part_version are the following:

- certification_required;
- supplier_part_number.

4.2.35.1 certification_required

The certification_required specifies that a supplier must be approved prior to the procurement of a part from that supplier.

4.2.35.2 supplier_part_number

The supplier_part_number specifies the part number used within the producing organization. The supplier_part_number need not be specified for a particular Supplied_part_version.

EXAMPLE 19 - Company A uses part 1234567-1 as part of an assembly. This part is actually purchased from company B, but additional testing is performed on each item received to assure it meets the requirements of the assembly. Company B identifies this part as AABBCCD-E. Company A identifies Company B as supplier number 52088. Within Company A, the part is identified as a Part with a part number of 1234567-1. The supplier is company B. The supplier code is 52088, and the supplier part number is AABBCCD-E.

4.2.36 Supplier

A Supplier is the organization that produces the part or the design of the part. The data associated with a Supplier is the following:

- supplier_id;

The supplier_id specifies the unique identification of the producing organization. This identification may be an organization-unique code, an industry-unique code or internationally recognized code.

4.2.37 Surface_finish_specification

A Surface_finish_specification is a type of Specification (see 4.2.31) that specifies properties that are applicable to surface textures or protective coatings for either an in-process or completed part.

4.2.38 Usage_constraint

A Usage_constraint is a restriction of the application of a Specification (see 4.2.31). It associates a particular topic of a specification with specific information or text to be used in its application for a particular instance. The data associated with a Usage_constraint are the following:

- element;
- value.

4.2.38.1 element

The element specifies the particular section or topic in a specification that is being constrained or clarified.

4.2.38.2 value

The value specifies limiting or particular data to be assigned to a section or topic in an element of a usage constraint.

EXAMPLE 20 - A part may require painting per a company written surface finish specification. The population would be: Specification_code = ABCD-1; Specification_source = XYZ Company; the paired Usage_constraint would be: Element = colour; Value = green; Element = coats; Value = 3.

4.2.39 Wireframe_with_topology

A Wireframe_with_topology is a type of Geometric_model_representation (see 4.2.1.1) that represents the shape or a portion of the shape of a part using wireframes that define an implicit volume or are

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trimmed by edge topology. This includes 3D curves and topology that define a graph of vertices and edges.

4.2.40 Work_order

A **Work_order** is a document that authorizes work in the development of an initial or modified design of a part. Each **Work_order** is either a **Start_order** (see 4.2.32) or a **Change_order** (see 4.2.5). It is the result of the processing of one or many **Work_requests** (see 4.2.41). The data associated with a **Work_order** are the following:

- **additional_data**;
- **analysis_data**;
- **work_order_id**.

4.2.40.1 additional_data

The **additional_data** specifies additional pertinent information that was compiled during the development of the related set of proposed work requests. The **additional_data** need not be specified for a particular **Work_order**.

4.2.40.2 analysis_data

The **analysis_data** specifies the results of an assessment that was performed to validate the design or modification in a related set of proposed work requests. The **analysis_data** need not be specified for a particular **Work_order**.

4.2.40.3 work_order_id

The **work_order_id** specifies a unique identifier for the work authorized by the **Work_order**.

4.2.41 Work_request

A **Work_request** is a document that identifies the work to be done to initiate or redefine the design of a part. Each **Work_request** is either a **Start_request** (see 4.2.33) or a **Change_request** (see 4.2.6). The data associated with a **Work_request** are the following:

- **description**;
- **reason**;
- **request_date**;

- status;
- work_request_id.

4.2.41.1 description

The description specifies an explanation of the work to be done to develop or redefine the design of a part.

4.2.41.2 reason

The reason specifies the purpose for generating the Work_request.

4.2.41.3 request_date

The request_date specifies the date when the Work_request was created.

4.2.41.4 status

The status specifies the current level of completion of the Work request. Valid values for the status of a Work_request are: proposed, in-work, issued, and hold.

4.2.41.5 work_request_id

The work_request_id specifies a unique identifier for the proposed work on a part's design.

4.3 Application assertions

This subclause specifies the application assertions for the configuration-controlled 3D designs of mechanical parts and assemblies Application Protocol. Application assertions specify all relationships among application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 Additional_design_information to Specification

Each Additional_design_information is a collection of one or many Specification objects. Each Specification is identified by exactly one Additional_design_information.

4.3.2 Approval to Person_organization

Each Approval is authorized by one or many Person_organization objects. Each Person_organization authorizes zero, one or many Approval objects.

4.3.3 Design_discipline_product_definition to Additional_design_information

Each Design_discipline_product_definition has zero, one or many Additional_design_information objects. Each Additional_design_information applies to one or many Design_discipline_product_definition objects.

4.3.4 Design_discipline_product_definition to Approval

Each Design_discipline_product_definition is approved by exactly one Approval. Each Approval approves zero, one or many Design_discipline_product_definition objects.

4.3.5 Design_discipline_product_definition to Engineering_assembly

Each Design_discipline_product_definition is used as a component in zero, one or many Engineering_assembly objects. Each Engineering_assembly component is defined by exactly one Design_discipline_product_definition.

Each Design_discipline_product_definition is the assembly for zero, one, or many Engineering_assembly objects. Each Engineering_assembly assembly is defined by exactly one Design_discipline_product_definition.

4.3.6 Design_discipline_product_definition to Engineering_make_from

Each Design_discipline_product_definition is the base design in zero, one or many Engineering_make_from objects. Each Engineering_make_from has a base design of exactly one Design_discipline_product_definition.

Each Design_discipline_product_definition is resultant design in zero, one or many Engineering_make_from objects. Each Engineering_make_from has a resultant design of exactly one Design_discipline_product_definition.

4.3.7 Engineering_assembly to Planned_effectivity

Each Engineering_assembly is effective in zero, one or many Planned_effectivity objects. Each Planned_effectivity affects exactly one Engineering_assembly.

4.3.8 Engineering_assembly to Substitute_part

Each Engineering_assembly has substitute components of zero, one or many Substitute_part objects. Each Substitute_part is a substitute for exactly one Part in an Engineering_assembly.

4.3.9 Engineering_next_higher_assembly to Component_assembly_position

Each Engineering_next_higher_assembly is located at zero or one Component_assembly_position. Each Component_assembly_position has exactly one Engineering_next_higher_assembly.

4.3.10 Geometric_model_representation to Component_assembly_position

Each Geometric_model_representation represents components in zero, one or many Component_assembly_position objects. Each Component_assembly_position is a component in exactly one Geometric_model_representation.

Each Geometric_model_representation represents an assembly in zero, one or many Component_assembly_position objects. Each Component_assembly_position is an assembly in exactly one Geometric_model_representation.

4.3.11 Part to Alternate_part

Each Part has an alternate of zero, one or many Alternate_part objects. Each Alternate_part is an alternate for one or many Part objects.

4.3.12 Part to Part_version

Each Part has one or many Part_version objects. Each Part_version of a Part shall define a variation of exactly one Part.

4.3.13 Part to Substitute_part

Each Part has substitutes of zero, one or many Substitute_part objects in a specific usage. Each Substitute_part is a Part object and substitutes for one or many Parts in a specified usage.

4.3.14 Part_version to Approval

Each Part_version is approved by exactly one Approval. Each Approval approves one or many Part_version objects.

4.3.15 Part_version to Design_discipline_product_definition

Each Part_version is defined by one or many Design_discipline_product_definition objects. Each Design_discipline_product_definition is a definition of exactly one Part_version.

4.3.16 Part_version to Supplied_part_version

Each Part_version is identified as one or many Supplied_part_version objects. Each Supplied_part_version corresponds to exactly one Part_version.

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4.3.17 Person_organization to Design_discipline_product_definition

Each Person_organization is the creator of zero, one or many Design_discipline_product_definition objects. Each Design_discipline_product_definition is created by exactly one Person_organization.

4.3.18 Person_organization to Part

Each Person_organization is the owner of zero, one or many Part objects. Each Part is owned by exactly one Person_organization.

4.3.19 Person_organization to Part_version

Each Person_organization is the creator of zero, one or many Part_version objects. Each Part_version is created by exactly one Person_organization.

4.3.20 Person_organization to Supplier

Each Person_organization identifies zero, one or many Supplier objects. Each Supplier is identified by exactly one Person_organization.

4.3.21 Planned_effectivity to Approval

Each Planned_effectivity is approved by exactly one Approval. Each Approval approves one or many Planned_effectivity objects.

4.3.22 Product_configuration to Approval

Each Product_configuration is approved by exactly one Approval. Each Approval approves one or many Product Configuration objects.

4.3.23 Product_configuration to Part

Each Product_configuration is satisfied by zero, one or many Part objects. Each Part satisfies zero, one or many Product_configuration objects.

4.3.24 Product_configuration to Planned_effectivity

Each Product_configuration has zero, one or many Planned_effectivity objects. Each Planned_effectivity identifies exactly one Product_configuration.

4.3.25 Product_model to Product_configuration

Each Product_model has one or many Product_configuration objects. Each Product_configuration is the configuration of exactly one Product_model.