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Part 210: Application protocol: Electronic assembly, interconnection, and packaging design

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

Partie 210: Protocole d'application: Interconnexions électroniques, assemblage, et conception d'emballage

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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 3.

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

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

International Standard ISO 10303-210 was prepared jointly by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*, and IEC/TC 3, *Information structures, documentation and graphical symbols*. The draft was circulated for voting to the national bodies of both ISO and IEC.

The technical committees involved have agreed not to change any part of this part of ISO 10303 without mutual agreement.

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

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

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

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

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

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Introduction

ISO 10303 is an International Standard for the computer-interpretable representation 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 representation of information needed for the requirements specification of, design of, and analysis of, electronic assemblies, interconnect, and packaging.

This AP includes information needed to support configuration management of the product data.

The detailed product data identify the functional and physical performance requirements for the product in its intended environment. The functional and physical interface requirements define the usage environment of the product. Configuration management information is part of the product data.

The detailed functional requirements data may be either functional parametric properties data or explicit detailed functional design data. The functional parametric properties data, used in conjunction with an externally defined analysis model, describe the behavior of the product. The detailed functional design data may be used to identify the usage of functional abstractions as components and the connections between those components.

The detailed device data identify the products used in the design and their critical functional and physical characteristics. The detailed device data are from the external or usage view of the device. The functional device characteristics may be represented as detailed functional design data, allowing the association of the detailed functional requirements data to available products.

The analysable description includes information, at a level of abstraction, for physically realizing the product design. The analysable description may include the functional interconnect of descriptions and analysis models. The analysable description may be detailed functional design data that identify connections between components or material features in a design. Sufficient information is included to support multi-level mixed functional or physical analysis of a system composed of the assembly or interconnect products.

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The detailed manufacturing capabilities data identify the material properties used as a basis in the design.

The manufacturable description includes information for physically realizing either the electronic assembly or interconnect product design. An assembly or a design may be used as a component in a different design, with geometry providing shape information in a geometric context.

The electronic assembly description is technology independent and identifies the products used as components and provides their placement and geometric shape data. These data support a detailed analysis of the performance of a product in its intended environment.

The interconnect product design describes the materials composing the interconnect, their arrangement in the interconnect physical structure, and their shape. The interconnect describes the arrangement and shape of material features of the interconnect product design. The interconnect description is technology independent.

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

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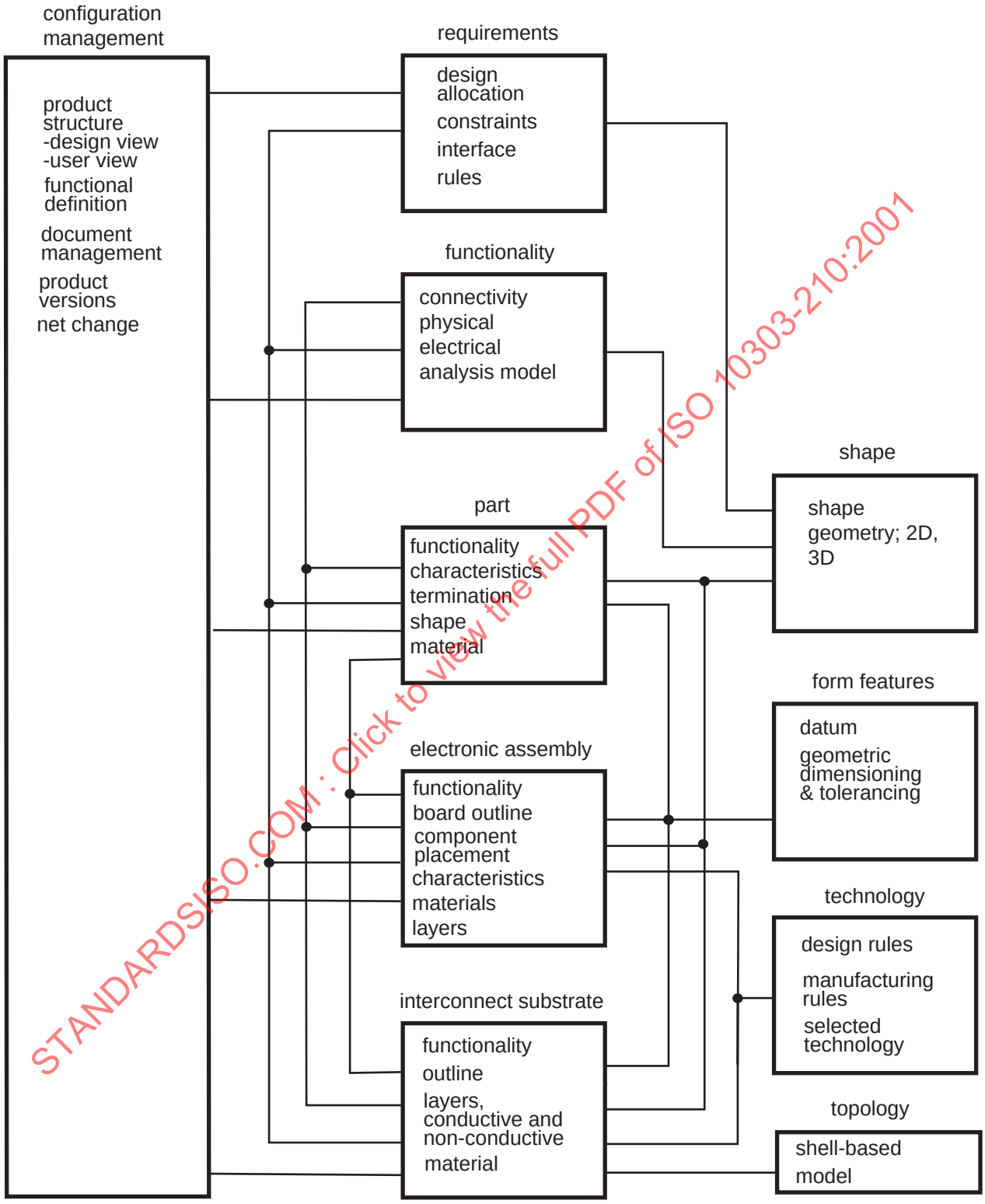

Figure 1 – Data planning model

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This application protocol defines the context, scope, and information requirements for information shared between device, system, design, and manufacturing process planning engineers for transforming detailed requirements data, detailed device data, detailed manufacturing capabilities data, and detailed functional design data into analysable and manufacturable descriptions 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 G. The information requirements for 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 H.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in clause 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 J. Additional requirements for specific implementation methods are given in annex C.

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

Part 210: Application protocol: Electronic assembly, interconnection, and packaging design

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1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the design of electronic assemblies, interconnect and packaging.

NOTE The application activity model (AAM) in Annex G provides a graphical representation of the processes and information flows that 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:

— The hierarchical description of the functionality of the electronic assembly or interconnect or devices that are used in an electronic assembly or interconnect;

— The hierarchical description of the functional objects that are combinations of one or more functional objects;

— The configuration management of the functional objects that are being developed concurrently;

— The configuration management of analytical models that are being developed concurrently;

— The explicit interface to analytic models that are used to define the behaviour of a functional object, a device, a physical object, an electronic assembly, or an interconnect;

— The description of the connection among the functional objects;

— The description of the connection among the devices used in the electronic assembly or interconnect;

— The description of the requirements for physical interconnection;

— The physical layout of the electronic assembly, including a description of the placement of the physical objects in the electronic assembly;

— The description of the bare interconnect, including the conductive and non-conductive materials and patterns;

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— The functional and physical description of devices or physical objects, including material characteristics and composition;

— The functional usage and physical usage description of devices or physical objects, including material characteristics and composition;

— The functional and physical description of devices or physical objects realized as part of the interconnect, including material characteristics and composition;

— The functional usage and physical usage description of devices or physical objects realized as part of the interconnect, including material characteristics and composition;

— The description of the requirements and constraints on the design of the electronic assembly that assure product performance, incorporate quality, and enhance manufacturing process capabilities;

— The description of the requirements and constraints on the design of the interconnect that assure product performance, incorporate quality, and enhance manufacturing process capabilities;

— The configuration management of electronic assembly design descriptions;

— The configuration management of interconnect design descriptions;

— The allocation of certain details of the interconnect design description to the usage description of a physical object;

— The allocation of certain details of the electronic assembly design description to the usage description of a physical object;

— The description of electronic assemblies to implement various functional domains including, but not limited to, analogue, digital, video, radio frequency, and microwave;

— The description of interconnect to implement various functional domains including, but not limited to, analogue, digital, video, radio frequency, and microwave;

— The configuration management of constituent parts that are electronic assemblies or interconnect and that are being concurrently developed;

— The configuration management of documents that contain requirements;

— The allocation of requirements to functional objects, physical objects, and the physical implementation;

— The allocation of requirements from functional objects to their physical implementation;

— The allocation of each specific connection among the devices used in the electronic assembly to the component or group of components that realizes that connection;

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— The association of characteristics to functional objects, physical objects, and analytical models;

— The identification of planned parameters for functional objects, electronic assemblies, interconnect, components, and analytical models;

— The identification of actual parameters for functional objects, electronic assemblies, interconnect, components, and analytical models.

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

— The drawings of functional objects, physical objects, electronic assemblies and interconnect;

— The process plans for the assembly of the electronic assembly;

— The process plans for the fabrication of the interconnect;

— The classification and categorization of data element types;

— The definition and interpretation of external file formats for analytic models;

— The management of the process used to design an electronic assembly or interconnect;

— The management of the manufacture of the physical objects used in an electronic assembly;

— The administrative procurement and cost data used by an enterprise.

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2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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: Implementation methods: Clear text encoding of the exchange structure.*

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ISO 10303–22:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 22: Implementation methods: Standard data access interface.*

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.*

ISO 10303–45:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resources: Materials.*

ISO 10303–46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation.*

ISO 10303–47:1997, *Industrial automation systems and integration — Product data representation and exchange — Part 47: Integrated generic resource: Shape variation tolerances.*

ISO 10303–501:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 501: Application interpreted construct: Edge-based wireframe.*

ISO 10303–502:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 502: Application interpreted construct: Shell-based wireframe.*

ISO 10303–503:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 503: Application interpreted construct: Geometrically bounded 2D wireframe.*

ISO 10303–514:1999, *Industrial automation systems and integration — Product data representation and exchange — Part 514: Application interpreted construct: Advanced boundary representation.*

ISO 10303–515:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 515: Application interpreted construct: Constructive solid geometry.*

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

IEC 60050–541:1990, *International Electrotechnical Vocabulary. Chapter 541: Printed circuits.*

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IEC 61182-1:1994, *Printed boards — Electronic data description and transfer — Part 1: Printed board description in digital form.*

IEC 61346–1:1996, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 1: Basic rules.*

ISO 129:1985, *Technical drawings — Dimensioning — General principles, definitions, methods of execution and special indications.*

ISO 1101:1995, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 2692:1988, *Technical drawings — Geometrical tolerancing — Maximum material principle*, and its Amendment 1:1992, *Least material requirement*.

ISO 8015:1985, *Technical drawings — Fundamental tolerancing principle.*

ISO/IEC 9592–1:1997, *Information technology — Computer graphics and image processing — Programmer's Hierarchical Interactive Graphics System (PHIGS) — Part 1: Functional description.*

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3 Terms, definitions, and abbreviations

3.1 Terms defined in IEC 60050-541

This part of ISO 10303 makes use of the following terms defined in IEC 60050-541:

— annular ring;

— blind via;

— buried via;

— cutout;

— double-sided board;

— fiducial;

— interfacial connection;

— land;

— non functional land;

— printed wiring;

— printed circuit;

— trace;

— via.

3.2 Terms defined in ISO 129

This part of ISO 10303 makes use of the following term defined in ISO 129:

— dimension.

3.3 Terms defined in ISO 1101

This part of ISO 10303 makes use of the following term defined in ISO 1101:

— tolerance zone.

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3.4 Terms defined in ISO 2692

This part of ISO 10303 makes use of the following terms defined in ISO 2692:

— least material condition;

— maximum material condition;

— maximum material principle.

3.5 Terms defined in ISO 2692: Amendment 1

This part of ISO 10303 makes use of the following term defined in ISO 2692: Amendment 1:

— least material requirement.

3.6 Terms defined in ISO 5459

This part of ISO 10303 makes use of the following terms defined in ISO 5459:

— datum;

— datum system.

3.7 Terms defined in ISO 8015

This part of ISO 10303 makes use of the following terms defined in ISO 8015:

— geometric tolerance;

— tolerance.

3.8 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 (AAM);

— application interpreted model (AIM);

— application object;

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— application protocol (AP);

— application reference model (ARM);

— assembly;

— conformance testing;

— data;

— implementation method;

— integrated resource;

— model;

— PICS proforma;

— product;

— product data;

— unit of functionality (UoF).

3.9 Terms defined in ISO 10303-11

This part of ISO 10303 makes use of the following terms defined in ISO 10303-11:

— domain rule;

— informal proposition;

— list;

— LOGICAL;

— SELF;

— set;

— unique rule.

3.10 Terms defined in ISO 10303-44

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

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— directed acyclic graph;

— parent node.

3.11 Terms defined in ISO 10303-45

This part of ISO 10303 makes use of the following term defined in ISO 10303-45:

— data environment.

3.12 Terms defined in ISO 10303-46

This part of ISO 10303 makes use of the following terms defined in ISO 10303-46:

— font;

— tiling.

3.13 Other definitions

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

3.13.1
component
an occurrence of a product used in an assembled product.

3.13.2
connected
joined; related or associated.

3.13.3
connection
the state of being connected.

3.13.4
connectivity
the state of being connected.

3.13.5
double-sided printed circuit board
a PCB with a conductive pattern on both of its sides.

3.13.6
flexible printed circuit board
a PCB that utilizes flexible insulating substrate materials with or without flexible insulating cover layers.

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3.13.7
functional object
a type of product design representation described as an assembly of functions or implied function.

3.13.8
functionality
the degree to which an object is designed or adapted to a particular function or use.

3.13.9
hierarchy
a collection of related items and where the relationship between the items may be represented by a directed acyclic graph in which a node has only one parent node.

3.13.10
hierarchical decomposition
a collection of related items and where the relationship between the items may be represented by a directed acyclic graph in which a node may have one or more parent nodes.

3.13.11
insulating substrate materials
materials with a high resistance to the flow of electrical current that are used as a base for the formation of conductive patterns.

3.13.12
integrated circuit
a miniature die of substrate material that is etched or imprinted with a complex of electronic components and their interconnections.

3.13.13
interface
an access mechanism to the functionality of an object.

3.13.14
multi-layer printed circuit board
a PCB that consists of rigid or flexible insulation materials and with three or more alternate printed wiring or printed circuit layers that have been bonded together and electrically interconnected.

3.13.15
nomenclature
a list of unique string types.

3.13.16
part
a product with operational functionality that is expected to be used as a component of one or more assembled products.

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EXAMPLE 1 The types of functionality are electrical, mechanical, electro-mechanical, magnetic, and optical.

3.13.17
port
an access mechanism.

3.13.18
printed circuit board layout
the geometric patterns and layered configurations of a bare printed circuit board.

3.13.19
printed component
a part manufactured during PCB fabrication.

3.13.20
rigid-flex printed circuit board
a PCB that utilizes both rigid and flexible insulating substrate materials.

3.13.21
rigid printed circuit board
a PCB that utilizes only rigid insulating substrate materials.

3.13.22
single-sided printed circuit board
a PCB with a conductive pattern on only one side.

3.13.23
structural domain
a domain in which each model explicitly states only one type of relationship between model elements.

3.14 Abbreviations

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

2D	two-dimension
3D	three-dimension
AAM	application activity model
AIM	application interpreted model
AP	application protocol
ARM	application reference model

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B-rep	boundary representation
CAD	computer-aided design
CSG	constructive solid geometry
EDA	electronic design automation
EE	electrical or electronics
EDIF	electronic design interchange format
EMI	electrical magnetic interference
IC	integrated circuit
IP	informal proposition
MCM	multi-chip module
PCA	printed circuit assembly
PCB	printed circuit board
PICS	Protocol information and conformance statement
RF	radio frequency
UoF	Units of Functionality
UR	unique rule
URL	uniform resource locator
VHDL	VHSIC hardware description language
VHSIC	very high speed integrated circuits
WR	domain rule

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4 Information requirements

This clause specifies the information required for information shared between device, system, design, and manufacturing process planning engineers for transforming detailed requirements data, detailed device data, detailed manufacturing capabilities data, and detailed functional design data into analysable and manufacturable descriptions.

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.

NOTE 1 A graphical representation of the information requirements is given in annex H.

NOTE 2 The information requirements correspond to those of the activities identified as being within the scope of this application protocol in annex G.

NOTE 3 The mapping table specified in 5.1 shows how the integrated resources and application interpreted constructs are used to meet the information requirements of this application protocol.

4.1 Units of functionality

This subclause specifies the units of functionality for the Electronic assembly, interconnect and packaging design application protocol. This Part of ISO 10303 specifies the following units of functionality:

— advanced_boundary_representation;

— altered_package;

— altered_part;

— analytical_model;

— analytical_representation;

— assembly_bill_of_material;

— assembly_component;

— assembly_component_grouping;

— assembly_component_placement_requirements;

— assembly_design_information_assignment_to_usage_view;

— assembly_functional_interface_requirement;

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— assembly_functional_requirement_allocation;

— assembly_interface_component;

— assembly_marking;

— assembly_module_design;

— assembly_module_usage_view;

— assembly_physical_interface_requirement;

— assembly_physical_requirement_allocation;

— assembly_shape;

— assembly_technology;

— authorization;

— bare_die;

— characteristic;

— connection_zone_to_analytical_model_port_mapping;

— constructive_solid_geometry;

— datum_based_characteristic;

— datum_difference_based_characteristic;

— datum_difference_based_model;

— design_activity_control;

— design_management;

— device_marking;

— document;

— end_item_identification;

— external_definition;

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— fabrication_joint;

— form_features;

— functional_decomposition_to_assembly_design;

— functional_decomposition_to_interconnect_design;

— functional_decomposition_with_nodal_representation;

— functional_decomposition_with_nodal_representation_to_assembly_mapping;

— functional_decomposition_with_nodal_representation_to_interconnect_mapping;

— functional_definition_to_physical_unit_usage_view_mapping;

— functional_definition_to_printed_part_mapping;

— functional_design_elaboration;

— functional_requirement_allocation;

— functional_specification;

— functional_unit_analytical_representation;

— functional_usage_view;

— functional_usage_view_terminal_to_analytical_model_port_mapping;

— geometric_dimensioning_and_tolerance;

— geometrically_bounded_2d_wireframe;

— inter_stratum_feature_template;

— interconnect_bill_of_material;

— interconnect_component_grouping;

— interconnect_design_information_assignment_to_usage_view;

— interconnect_functional_requirement_allocation;

— interconnect_interface_component;

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— interconnect_marking;

— interconnect_module_connection_routing;

— interconnect_module_design;

— interconnect_module_edge;

— interconnect_module_usage_view;

— interconnect_physical_requirement_allocation;

— interconnect_placement_requirements;

— interconnect_shape;

— laminate_assembly_design;

— land;

— library_item;

— manufacturing_technology;

— material_product;

— non_topological_surface;

— package;

— packaged_part_black_box_model;

— packaged_part_terminal_analytical_representation;

— packaged_part_white_box_model;

— part_feature;

— part_feature_to_analytical_model_port_mapping;

— part_template;

— part_template_shape;

— physical_network;

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— physical_unit;

— physical_unit_analytical_representation;

— physical_unit_shape;

— planned_characteristic;

— planned_effectivity;

— printed_part_template;

— product_identification;

— product_requirement_allocation;

— product_rule;

— requirement_decomposition;

— sequential_laminate_assembly_design;

— shape;

— signal;

— solid_of_linear_extrusion;

— source_control;

— stratum;

— stratum_feature;

— stratum_position;

— styled_curve;

— styled_text;

— test_probe;

— wireframe_2d_model_with_topology;

— 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 4.2

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4.1.1 advanced_boundary_representation

The advanced_boundary_representation UoF defines the information needed for a representation of a product using advanced boundary representation solids 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 product's shape shall be associated with topology.

The following application objects are used by the advanced_boundary_representation UoF:

— Advanced_b_rep.

4.1.2 altered_package

The altered_package UoF defines the properties of a package that has had some preparation work done to it that modifies the form or fit or material properties of the package. The preparation work is necessary to facilitate installation or support alternate mounting arrangements. The altered_package UoF is included to support the exchange of package related information independently of the usage of the package.

The following application objects are used by the altered_package UoF:

— Altered_package;

— Altered_package_terminal.

4.1.3 altered_part

The altered_part UoF defines the properties of a component that has had some preparation work done to it that modifies the form or fit or function or material properties of the component and is usually installed in the product to be delivered to a customer. The preparation work may be necessary to facilitate the installation, or to support alternate mounting arrangements, or to support field programmability. The altered_part UoF does not distinguish between the properties of a component that has been altered prior to installation and the properties of a component that has been altered, installed and delivered to a customer as part of the assembly.

NOTE Enterprises typically do not document component shape changes that are minor that occur during production of the assembly (e.g., an operation that trimmed leads would be ignored.).

The following application objects are used by the altered_part UoF:

— Altered_package;

— Altered_package_terminal;

— Altered_packaged_part;

— Engineering_make_from.

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4.1.4 analytical_model

The analytical_model UoF defines the information needed to properly interface to and exchange the source code contents of an externally defined computer-interpretable model of a particular behaviour. A model allows a behaviour to be described using a mathematical form (e.g., algorithm, table). A model is independent of any particular product.

The following application objects are used by the analytical_model UoF:

— Analytical_model;

— Analytical_model_port;

— Analytical_model_scalar_port;

— Analytical_model_vector_port;

— Digital_analytical_model_port;

— Language_reference_manual;

— Model_parameter;

— Terminal_pair_port_equivalence_relationship.

4.1.5 analytical_representation

The analytical_representation UoF defines the information needed to associate specific instance data with an analytical model to support computer-based experimentation. The models are associated with a network representation in order to form a complete system of equations for numerical or symbolic analysis. Each discipline may have a different analytical representation of a product design.

NOTE The network representation commonly used, a nodal representation is supported by the functional_decomposition_with_nodal_representation UoF.

The following application objects are used by the analytical_representation UoF:

— Analytical_representation.

4.1.6 assembly_bill_of_material

The assembly_bill_of_material UoF defines the information needed to describe the structured list of materials of components required for an assembly. The assembly_bill_of_material UoF includes the vendor supplying the product, all approved alternates and substitutes, and which product selection is dependent on the result of a test of the assembly.

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The following application objects are used by the assembly_bill_of_material UoF:

— Alternate_product;

— Alternate_select_product;

— Assembly_alternate_product;

— Assembly_composition_relationship;

— Assembly_material_composition_relationship;

— Next_higher_assembly_relationship;

— Promissory_usage_relationship;

— Substitute_product;

— Test_select_product.

4.1.7 assembly_component

The assembly_component UoF defines the information needed to incorporate occurrences of the different types of physical units as components in an assembly. The assembly_component UoF defines the information needed to incorporate components that use the different types of part templates as definitions in an assembly. The assembly_component UoF defines auxiliary roles a component may assume in an assembly in support of other components in addition to the primary role of component. The assembly_component UoF functionality supports discrete and fabricated assemblies.

The following application objects are used by the assembly_component UoF:

— Assembly_component;

— Assembly_module_component;

— Bare_die_component;

— Interconnect_module_component;

— Interface_component;

— Packaged_component;

— Packaged_connector_component;

— Routed_interconnect_component;

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— Routed_packaged_component;

— Shield;

— Thermal_component.

4.1.8 assembly_component_grouping

The assembly_component_grouping UoF defines the information needed to describe the different ways of grouping assembly components in an assembly. The assembly_component_grouping UoF functionality supports discrete and fabricated assemblies. The assembly_component_grouping UoF functionality supports design reuse of complex design elements.

NOTE The assembly_component_grouping UoF is not intended to be the means to support hierarchical design, as that is the purpose of the assembly_module_design and interconnect_module_design UoFs.

The following application objects are used by the assembly_component_grouping UoF:

— Array_placement_group;

— Assembly_group_component;

— Interfaced_group_component;

— Sub_assembly_relationship.

4.1.9 assembly_component_placement_requirements

The assembly_component_placement_requirements UoF defines the information needed to describe the constraints restricting where components are to be placed in an assembly. These restrictions may be component category to board feature category or component category to component category related. Application object attribute data population is restricted to that related to the discrete assembly view.

The following application objects are used by the assembly_component_placement_requirements UoF:

— Component_group_assignment;

— Component_placement_restriction_assignment;

— Interconnect_module_component_surface_feature;

— Item_restricted_requirement_occurrence;

— Layout_spacing_requirement_occurrence;

— Mounting_restriction_area;

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— Placement_group;

— Placement_group_area_assignment.

4.1.10 assembly_design_information_assignment_to_usage_view

The assembly_design_information_assignment_to_usage_view UoF defines the information that describes the association between product data necessary for a design view and product data necessary to define a usage view. A product engineer may choose to only release usage view information in order to allow other designers to incorporate the product into a higher level assembly. This information is developed and maintained by a design organization in order to control the accuracy and integrity of externally released data.

The following application objects are used by the assembly_design_information_assignment_to_usage_-view UoF:

— Component_feature_to_physical_usage_view_assignment;

— Component_terminal_to_assembly_module_terminal_assignment;

— Component_terminal_to_pca_terminal_assignment.

4.1.11 assembly_functional_interface_requirement

The assembly_functional_interface_requirement UoF defines the information needed to describe the manner by which an electronic assembly shall electrically or functionally interface to the next higher assembly. Constraints on the signals associated with terminals of the mating connector may be specified. Identification of the mating terminals is supported.

The following application objects are used by the assembly_functional_interface_requirement UoF:

— Mating_connector_termination;

— Termination_constraint.

4.1.12 assembly_functional_requirement_allocation

The assembly_functional_requirement_allocation UoF describes the assignment of network based functional requirements to an assembly under design. These requirements are specific to the relationship betwen the functional connectivity definition and the component instances used in the assembly under design that implement that connectivity.

NOTE Refer to the functional_requirement_allocation UoF for information assigning textual requirements to a functional decomposition.

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The following application objects are used by the assembly_functional_requirement_allocation UoF:

— Physical_node_requirement_to_implementing_component_allocation.

4.1.13 assembly_interface_component

The assembly_interface_component UoF defines the information needed to describe the component that acts as a connector that provides external access to an assembly. The items' position in the assembly, and the specification that dictates the selection and placement are included.

The following application objects are used by the assembly_interface_component UoF:

— Ee_specification;

— Interface_component;

— Packaged_connector_component.

4.1.14 assembly_marking

The assembly_marking UoF defines the information needed to apply identification information, using material, to an assembly. The content of the information is under configuration control. The scope of this UoF is for assemblies.

The following application objects are used by the assembly_marking UoF:

— Configuration_controlled_message;

— Ee_specification;

— Marking.

4.1.15 assembly_module_design

The assembly_module_design UoF defines the information needed to describe the components in an assembly and the physical relationship between the components and the assembly. The assembly_-module_design UoF defines the information needed to describe the different features of components and the relationship between component features in an assembly. The assembly_module_design UoF defines the information needed to describe the materials used in an assembly that physically support components. Analysis data extraction is supported to allow verification of physical connectivity implementation.

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The following application objects are used by the assembly_module_design UoF:

— Assembled_with_bonding;

— Assembled_with_fasteners;

— Assembly_component;

— Assembly_composition_relationship;

— Assembly_joint;

— Assembly_material_composition_relationship;

— Assembly_module;

— Assembly_module_component_terminal;

— Bare_die_component_terminal;

— Component_feature;

— Component_feature_make_from_relationship;

— Component_feature_relationship;

— Component_interface_terminal;

— Component_make_from_relationship;

— Component_mounting_clearance_relationship;

— Component_overlap_relationship;

— Component_terminal;

— Connection_zone_based_assembly_joint;

— Interconnect_component_interface_terminal;

— Interconnect_component_join_terminal;

— Interconnect_module_component_surface_feature;

— Interconnect_module_component_terminal;

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— Interface_mounted_join;

— Next_higher_assembly_relationship;

— Package_terminal_occurrence;

— Packaged_component_join_terminal;

— Packaged_connector_component_interface_terminal;

— Pca.

4.1.16 assembly_module_usage_view

The assembly_module_usage_view UoF defines the information needed to describe the electronic assembly for use as a component at the next level of assembly. The level of information provided is for use of the electronic assembly and not manufacture.

The following application objects are used by the assembly_module_usage_view UoF:

— Assembly_module_terminal;

— Assembly_module_usage_view;

— Assembly_module_usage_view_connector_relationship;

— Packaged_connector;

— Pca_terminal;

— Pca_usage_view.

4.1.17 assembly_physical_interface_requirement

The assembly_physical_interface_requirement UoF defines the information needed to describe the manner by which an electronic assembly shall mechanically interface to the next higher assembly. The type of mating connector and its location relative to the electronic assembly are provided as a design requirement, that must be satisfied in the design.

The following application objects are used by the assembly_physical_interface_requirement UoF:

— Component_placement_restriction_assignment;

— Interface_requirement_occurrence;

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— Mating_connector_component;

— Mating_connector_placement_relationship;

— Next_higher_assembly_interface_requirement.

4.1.18 assembly_physical_requirement_allocation

The assembly_physical_requirement_allocation UoF describes the assignment of customer, regulatory agency, and enterprise requirements to an assembly under design. These requirements may be assigned to physical items or geometric features that are used in various phases of the design process.

The following application objects are used by the assembly_physical_requirement_allocation UoF:

— Assembly_requirement_allocation;

— Assembly_separation_requirement_allocation;

— Electromagnetic_compatibility_requirement_allocation;

— Interface_component_allocation;

— Requirement_allocation;

— Shield_allocation;

— Thermal_requirement_allocation.

4.1.19 assembly_shape

The assembly_shape UoF defines the information needed to describe explicit geometric models and transformations used in the design process for an electronic assembly. This UoF permits a different type of geometric representation for a component in a library and for an instance of the component in the design.

The following application objects are used by the assembly_shape UoF:

— Assembly_component_2d_shape;

— Assembly_component_3d_shape;

— Bond_assembly_position;

— Component_2d_edge_location;

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— Component_2d_location;

— Component_3d_location;

— Component_assembly_2d_position;

— Component_assembly_3d_position;

— Component_part_2d_geometric_representation_relationship;

— Component_part_3d_geometric_representation_relationship.

4.1.20 assembly_technology

The assembly_technology UoF defines the information needed to describe the different aspects of how components are joined together to make an assembly. The assembly_technology UoF defines the information needed to describe the material used in making the physical connections and their typical shape.

The following application objects are used by the assembly_technology UoF:

— Assembly_bond_definition;

— Assembly_technology_specification;

— Default_assembly_bond_shape.

4.1.21 authorization

The authorization UoF defines the information necessary to determine the acceptance of a piece of product data within an enterprise, 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:

— Contract;

— Date;

— Date_and_time;

— Ee_approval;

— Organization;

— Person;

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— Person_and_organization;

— Security_classification.

4.1.22 bare_die

The bare_die UoF defines the information needed to describe a semiconductor material product that may reside inside an integrated circuit, or that may be a discrete active component, or that may be included as a component in an electronic assembly. Terminal information is supported, including explicit shape data.

The following application objects are used by the bare_die UoF:

— Bare_die;

— Bare_die_terminal;

— Connection_zone_interface_plane_relationship;

— Guided_wave_bare_die_terminal;

— Minimally_defined_bare_die_terminal;

— Seating_plane.

4.1.23 characteristic

The characteristic UoF defines the information needed to describe parameters and tolerances for a physical unit, a template, a design, or a model. Explicit units, as well as exact and uncertain measures may be described.

The following application objects are used by the characteristic UoF:

— Angle_data_element;

— Characteristic;

— Coordinated_characteristic;

— Data_element;

— Ee_colour;

— Length_data_element;

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— Maximum_tolerance_characteristic;

— Minimum_tolerance_characteristic;

— Model_parameter;

— Numeric_parameter;

— Parameter_assignment;

— Plus_minus_tolerance_characteristic;

— Qualified_data_element;

— Statistical_tolerance_characteristic;

— Symmetrical_tolerance_characteristic;

— Tolerance_characteristic.

4.1.24 connection_zone_to_analytical_model_port_mapping

The connection_zone_to_analytical_model_port_mapping UoF defines the information needed to associate specific geometric founded data for a physical unit to an analytical model port to support computer-based experimentation on a specific product design. Each discipline may have a different connection zone to analytical model port mapping for a product design. Direct specification of the mapping to a connection area on the terminal of the product concepts under investigation is provided. This UoF provides additional level of detail over that found in the part_feature_to_analytical_model_port_mapping UoF.

The following application objects are used by the connection_zone_to_analytical_model_port_mapping UoF:

— Connection_zone_model_port_assignment.

4.1.25 constructive_solid_geometry

The constructive_solid_geometry UoF defines the information needed to describe the solid representation of an item by use of primitive solid construction elements. These primitive elements may be intersected, unioned, and differenced with each other in order, to form desired representation. The construction history of the solid is included by default.

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The following application objects are used by the constructive_solid_geometry UoF:

— Block;

— Boolean_csg_result;

— Csg_primitive;

— Csg_solid;

— Right_angular_wedge;

— Right_circular_cylinder.

4.1.26 datum_based_characteristic

The datum_based_characteristic UoF defines the information needed to describe parameters for a physical unit, a template, a design, or a model, where the characteristic is based on a Datum.

The following application objects are used by the datum_based_characteristic UoF:

— Datum_based_length_measure.

4.1.27 datum_difference_based_characteristic

The datum_difference_based_characteristic UoF defines the information needed to describe parameters for a physical unit, a template, a design, or a model where the characteristic is based on a Datum_-difference.

The following application objects are used by the datum_difference_based_characteristic UoF:

— Datum_difference;

— Datum_difference_based_characteristic.

4.1.28 datum_difference_based_model

The datum_difference_based_model UoF defines the information needed to properly interface to and exchange an externally defined computer-interpretable model of a particular product that includes interfaces based on Datums. A datum_difference_based_model allows a product's characteristics and performance parameters to be described analytically and referenced to a base or reference computer interpretable geometric model. A datum_difference_based_model is an extension of the Analytical_model UoF.

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The following application objects are used by the datum_difference_based_model UoF:

— Analytical_model;

— Analytical_model_port;

— Analytical_model_scalar_port;

— Analytical_model_vector_port;

— Datum_difference;

— Datum_difference_analytical_model_port_assignment;

— Datum_difference_based_model_parameter;

— Datum_difference_functional_unit_usage_view_terminal_assignment;

— Digital_analytical_model_port;

— Language_reference_manual;

— Model_parameter;

— Terminal_pair_port_equivalence_relationship.

4.1.29 design_activity_control

The design_activity_control UoF defines the information necessary to describe the history of product versions. It identifies initial product design requests, as well as change requests for revised product versions. It provides the directive for work to proceed in the development of these initial or modified product versions.

The following application objects are used by the design_activity_control UoF:

— Change_order;

— Change_request;

— Start_order;

— Start_request;

— Work_order;

— Work_request.

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4.1.30 design_management

The design_management UoF defines the information needed to describe the association between an original product definition and a planned product definition. The planned product definition is based upon the original definition.

The following application objects are used by the design_management UoF:

— Add_design_object_management_relationship;

— Change_design_object_management_relationship;

— Delete_design_object_management_relationship;

— Design_object_management_relationship;

— Frozen_design_object;

— Managed_design_object.

4.1.31 device_marking

The device_marking UoF defines the information needed to apply identification information, using material, to an item used in a design for identification of that item. The content of the information is under configuration control. The scope of this UoF is for library data.

The following application objects are used by the device_marking UoF:

— Configuration_controlled_message;

— Ee_specification;

— Marking.

4.1.32 document

The document UoF defines the information needed to describe a set of different types of information elements that are found in a document that are used to specify, in detail, a product or an aspect of a product or model. Support is provided for describing text that is a part of a document.

EXAMPLE 1 Source code for models or requirements is data which may be exchanged using the capabilities of this UoF.

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The following application objects are used by the document UoF:

— Design_specification;

— Ee_document;

— Ee_document_identifier;

— Ee_specification;

— Ee_text;

— Fabrication_technology_specification;

— Interface_specification;

— Language_reference_manual;

— Lead_form_specification;

— Material_specification;

— Process_specification;

— Structured_text;

— Surface_finish_specification;

— Test_specification.

4.1.33 end_item_identification

The end_item_identification UoF defines the information needed to describe the version of the product that is being provided to satisfy the customer's requirements.

The following application objects are used by the end_item_identification UoF:

— Ee_product_configuration;

— Ee_product_model.

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4.1.34 external_definition

The external_definition UoF defines the information needed to describe any definitions that are not predefined in this part of ISO 10303. The external definition requires a computer interpretable data dictionary for the most effective implementation.

The following application objects are used by the external_definition UoF:

— External_definition.

4.1.35 fabrication_joint

The fabrication_joint UoF defines the information needed to describe a joint created during the interconnect substrate manufacturing process. The joint purpose is to describe an intended connection between the interconnect substrate materials. The joint concept may be for strictly design or analysis purposes and may not be resolvable as a separate feature in the finished product.

The following application objects are used by the fabrication_joint UoF:

— Fabrication_joint;

— Interconnect_module_product_assembly_view_fabrication_joint.

4.1.36 form_features

The form_features UoF defines the information needed to describe certain explicitly modeled parametrically defined geometric feature definitions provided by this part of ISO 10303.

The following application objects are used by the form_features UoF:

— Bevel_edge_feature_shape;

— Blind_passage_template;

— Counterbore_passage_template;

— Countersunk_passage_template;

— Datum;

— Edge_shape;

— Interconnect_module_edge_segment_surface;

— Interconnect_module_primary_surface;

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— Interconnect_module_secondary_surface;

— Interconnect_module_surface_feature;

— Radius_edge_feature_shape;

— Step_edge_feature_shape.

4.1.37 functional_decomposition_to_assembly_design

The functional_decomposition_to_assembly_design UoF defines the information needed to describe the assignment of a functional unit in a network definition to an element in the assembly. Usually, this information is provided by a packaging application. This UoF defines the different means of describing swapping accomplished within a design. The types of swapping covered are the ones between gates in a single package instance, between gates in different package instances, and between terminals in a gate.

NOTE Constraints on swapping are not included in this UoF. The terminals swapped with this UoF are on the functional elements in the hierarchical design network listing and not the flattened network listing. Applications that perform swapping on flattened representations will need to map to the hierarchical representation.

The following application objects are used by the functional_decomposition_to_assembly_design UoF:

— Component_swap_specification;

— Design_composition_path;

— Design_functional_unit_allocation_to_assembly_component;

— Design_functional_unit_allocation_to_assembly_joint;

— Gate_path_swap_specification;

— Terminal_swap_specification.

4.1.38 functional_decomposition_to_interconnect_design

The functional_decomposition_to_interconnect_design UoF defines the information needed to describe the assignment of a functional unit in a network definition to an element in the Interconnect_module. The functional_decomposition_to_interconnect_design UoF defines the different means of performing swapping within a design. The types of swapping covered are the ones between gates in a single printed part, between identical gates in different instances of a printed part, and between terminals of identical type and behaviour in a gate.

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The following application objects are used by the functional_decomposition_to_interconnect_design UoF:

— Component_swap_specification;

— Design_composition_path;

— Design_functional_unit_allocation_to_assembly_component;

— Design_functional_unit_allocation_to_fabrication_joint;

— Gate_path_swap_specification;

— Terminal_swap_specification;

— Transmission_line_functional_unit_terminal_allocation;

— Transmission_line_functional_unit_to_routed_printed_component_allocation.

4.1.39 functional_decomposition_with_nodal_representation

The functional_decomposition_with_nodal_representation UoF defines the information needed to describe how a set of functional units are connected together to form a network. The individual connections may either be discrete or may be part of a defined bus structure. The network may be specified as electrical, thermal, or unspecified (to be resolved by the simulation environment).

NOTE The analytical_representation and analytical_model UoFs are also needed to build a complete set of input data for a simulation experiment, as this UoF only provides the network structure.

The following application objects are used by the functional_decomposition_with_nodal_representation UoF:

— Bus_element_relationship;

— Bus_structural_definition;

— Electrical_network_definition;

— Functional_unit;

— Functional_unit_definition;

— Functional_unit_network_definition;

— Functional_unit_network_node_definition;

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— Functional_unit_network_terminal_definition_bus_assignment;

— Functional_unit_network_terminal_definition_node_assignment;

— Functional_unit_terminal;

— Functional_unit_terminal_bus_assignment;

— Functional_unit_terminal_node_assignment;

— Functional_unit_usage_view;

— Functional_unit_usage_view_terminal_definition;

— Thermal_network_definition.

4.1.40 functional_decomposition_with_nodal_representation_to_assembly_mapping

The functional_decomposition_with_nodal_representation_to_assembly_mapping UoF defines the information necessary to describe the association between the mult-level hierarchical nodal representation and the single level nodal representation described by a physical_connectivity_definition. Multi-level hierarchy is represented in this part of ISO 10303 by a graph, and there are several graph instances involved in this UoF. The lowest level primitives in the design graph are also the lowest level primitives in the functional definition of a physical unit. A mapping is defined between paths contained in two graph instances in order to define equivalent functionality for a design element and a library element that contributes to the functionality of a physical_unit or part_template whose definition is in a library. Information is provided to exchange the constraints determined on the allowed alternatives that may be selected by a mapping activity. The constraints may be applied to individual elements and also to individual terminals.

EXAMPLE 1 A packaging application that used this mapping would assign element names "A,B,C" of a multi-element part to three path instances in the design. A second mapping is defined to allow the packaging application to associate the reference designator of the assembly_component to the three paths through the design graph that are implemented with that assembly_component. It may be determined by the design activity that element "A" is permitted to be exchanged with element "B" but not with element "C".

The following application objects are used by the functional_decomposition_with_nodal_representation_to_assembly_mapping UoF:

— Aggregate_connectivity_requirement;

— Component_terminal;

— Connectivity_allocation;

— Design_composition_path;

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— Design_functional_unit_allocation_to_assembly_component;

— Design_functional_unit_allocation_to_reference_functional_unit;

— Functional_usage_view_to_part_terminal_assignment;

— Minimally_defined_component_terminal;

— Package_external_reference;

— Package_terminal_external_reference;

— Part_terminal_external_reference;

— Reference_composition_path;

— Reference_functional_unit_assignment_to_part.

4.1.41 functional_decomposition_with_nodal_representation_to_interconnect_mapping

The functional_decomposition_with_nodal_representation_to_interconnect_mapping UoF defines the information necessary to describe the association between the multi-level hierarchical nodal representation and the single level nodal representation described by a physical_connectivity_definition that is in the design view of an interconnect. Multi-level hierarchy is represented in this part of ISO 10303 by a graph, and there are several graph instances involved in this UoF. The lowest level primitives in the design graph are also the lowest level primitives in the functional definition of a part template. A mapping is defined between paths contained in two graph instances in order to define equivalent functionality for a design element and a library element that contributes to the functionality of a part_template whose definition is in a library. Information is provided to exchange the constraints determined on the allowed alternatives that may be selected by a mapping activity. The constraints may be applied to individual elements and also to individual terminals.

EXAMPLE 1 A packaging application that used this mapping would assign element names "A,B,C" of a multi-element part to three path instances in the design. A second mapping is defined to allow the packaging application to associate the reference designator of the assembly_component to the three paths through the design graph that are implemented with that assembly_component. It may be determined by the design activity that element "A" is permitted to be exchanged with element "B" but not with element "C".

NOTE The population of assembly_component supported by this UoF is the types of laminate_component.

The following application objects are used by the functional_decomposition_with_nodal_representation_to_interconnect_mapping UoF:

— Aggregate_connectivity_requirement;

— Connectivity_allocation;

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— Design_composition_path;

— Design_functional_unit_allocation_to_assembly_component;

— Design_functional_unit_allocation_to_reference_functional_unit;

— Functional_usage_view_to_part_terminal_assignment;

— Reference_composition_path;

— Reference_functional_unit_assignment_to_part.

4.1.42 functional_definition_to_physical_unit_usage_view_mapping

The functional_definition_to_physical_unit_usage_view_mapping UoF defines the association between functional elements and the physical units that exhibit the behaviour defined in the functional element. The functional_definition_to_physical_unit_usage_view_mapping UoF defines minimal information needed for classifying the association to support design alternative selection (e.g., swapping) during the detailed design activity.

The following application objects are used by the functional_definition_to_physical_unit_usage_view_-mapping UoF:

— Functional_usage_view_to_part_terminal_assignment;

— Reference_composition_path;

— Reference_functional_unit_assignment_to_part.

4.1.43 functional_definition_to_printed_part_mapping

The functional_definition_to_printed_part_mapping UoF defines the association between a functional element and a printed part template that exhibits the behaviour defined in the functional definition. The functional_definition_to_printed_part_mapping UoF defines minimal information needed for classifying the association to support design alternative selection (e.g., swapping) during the detailed design activity.

The following application objects are used by the functional_definition_to_printed_part_mapping UoF:

— Functional_usage_view_to_printed_part_template_terminal_assignment;

— Reference_composition_path;

— Reference_functional_unit_assignment_to_part.

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4.1.44 functional_design_elaboration

The functional_design_elaboration UoF defines the information needed to describe the structure of a network realization (flattened listing). It furthermore states the requirements which dictated the topological design of the realized network. It states constraints on exchange of terminal assignments to achieve the desired functionality.

EXAMPLE 1 A constraint may be a swapping constraint to ensure required fan-in capability.

The following application objects are used by the functional_design_elaboration UoF:

— Connectivity_sub_structure;

— Minimally_defined_component_terminal;

— Part_terminal_external_reference;

— Physical_connectivity_definition;

— Physical_connectivity_definition_relationship;

— Physical_connectivity_element;

— Physical_connectivity_make_from_relationship;

— Physical_connectivity_structure_definition;

— Topological_junction.

4.1.45 functional_requirement_allocation

The functional_requirement_allocation UoF describes the assignment of customer, regulatory agency, and enterprise requirements to a functional element in a network under design or to a functional specification. These requirements may be assigned for various purposes and phases of the design process.

The following application objects are used by the functional_requirement_allocation UoF:

— Functional_specification_to_requirement_occurrence_assignment;

— Functional_unit_requirement_allocation.

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4.1.46 functional_specification

The functional_specification UoF defines the information needed to describe the measured behaviour of a functional element under a set of controlled conditions. It also defines the information needed to describe equivalents among different functional elements.

The following application objects are used by the functional_specification UoF:

— Equivalent_functional_unit_definition_assignment;

— Functional_specification;

— Signal_specification.

4.1.47 functional_unit_analytical_representation

The functional_unit_analytical_representation UoF defines the information needed to associate specific functional definitions with an analytical model to support computer-based experimentation. Each analysis model port is explicitly mapped to a terminal of the functional definition. Domain specific analysis is supported by a predefined type system and predefined units for simulation variables.

The following application objects are used by the functional_unit_analytical_representation UoF:

— Analytical_model_port_assignment;

— Analytical_model_vector_port_assignment;

— Analytical_representation.

4.1.48 functional_usage_view

The functional_usage_view UoF defines the information needed to describe the characterized behaviour and interface of a functional element. The terminals of the functional element may be assigned type information to facilitate a swapping application.

The following application objects are used by the functional_usage_view UoF:

— Equivalent_functional_terminals_assignment;

— Functional_terminal_group;

— Functional_terminal_group_assignment;

— Functional_unit_usage_view;

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— Functional_unit_usage_view_terminal_definition;

— Scalar_terminal_definition.

4.1.49 functional_usage_view_terminal_to_analytical_model_port_mapping

The functional_usage_view_terminal_to_analytical_model_port_mapping UoF defines the information needed to describe the assignment between a terminal of a functional element and a port of an analytical model. This is used in analysing a design. This UoF supports assigning explicit behaviour that is defined in a simulation model to a functional element.

NOTE The behavioural assignment is a consequence of the assignment of the terminals between the functional element and the simulation model.

The following application objects are used by the functional_usage_view_terminal_to_analytical_model_-port_mapping UoF:

— Analytical_model_port_assignment;

— Analytical_model_vector_port_assignment.

4.1.50 geometric_dimensioning_and_tolerance

The geometric_dimensioning_and_tolerance UoF defines the information required to describe a behavioural model of a physical_unit and associated properties using geometric dimensioning and tolerancing principles in accordance with pre-existing standards.

The following application objects are used by the geometric_dimensioning_and_tolerance UoF:

— Angular_dimension_with_direction_vector;

— Angular_size_dimension;

— Angularity_tolerance;

— Apex;

— Axis_placement;

— Axis_placement_2d;

— Axis_placement_3d;

— Boundary_based_position_tolerance;

— Boundary_size_characteristic;

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— Boundary_zone_definition_with_specified_size;

— Centre_axis;

— Centre_of_symmetry;

— Centre_plane;

— Centre_point;

— Circular_runout_tolerance;

— Circularity_tolerance;

— Common_datum;

— Composite_feature_locating_position_tolerance;

— Composite_feature_relating_position_tolerance;

— Composite_group_shape_element;

— Composite_linear_profile_locating_tolerance;

— Composite_linear_profile_refinement_tolerance;

— Composite_shape_element;

— Composite_surface_profile_locating_tolerance;

— Composite_surface_profile_refinement_tolerance;

— Composite_unit_shape_element;

— Concentricity_and_coaxiality_tolerance;

— Conical_tolerance_zone_boundary;

— Conical_tolerance_zone_boundary_and_surface_relationship;

— Conical_tolerance_zone_boundary_definition;

— Conical_tolerance_zone_boundary_diametrical_size_characteristic;

— Conical_tolerance_zone_definition;

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— Curve_dimension;

— Cylindricity_tolerance;

— Datum;

— Datum_axis;

— Datum_axis_and_tolerance_zone_orienting_relationship;

— Datum_axis_related_orientation;

— Datum_based_direction_vector;

— Datum_based_vector_orientation;

— Datum_feature;

— Datum_feature_material_condition_property;

— Datum_feature_usage_in_common_datum_relationship;

— Datum_feature_usage_in_datum_relationship;

— Datum_feature_usage_in_datum_system_relationship;

— Datum_feature_usage_in_single_datum_relationship;

— Datum_plane;

— Datum_point;

— Datum_precedence_assignment;

— Datum_reference_frame;

— Datum_system;

— Datum_system_defining_conditions;

— Datum_system_defining_conditions_with_material_conditions;

— Datum_system_defining_conditions_without_material_conditions;

— Datum_target;

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— Datum_target_set;

— Datum_target_usage_in_datum_target_set_relationship;

— Datum_usage_in_datum_system_relationship;

— Derived_shape_element;

— Diametrical_boundary_size_characteristic;

— Dimension_along_curve;

— Dimension_location_with_direction_vector;

— Dimension_location_with_specified_datum_system;

— Dimension_qualifier;

— Dimension_related_positional_boundary;

— Dimension_related_positional_boundary_definition;

— Dimension_set;

— Dimensional_characteristic;

— Dimensional_characteristic_representation;

— Dimensional_location;

— Dimensional_size;

— Dimensional_size_based_on_opposing_boundaries;

— Directed_axis;

— Direction_element;

— Externally_defined_dimension_representation;

— Flatness_tolerance;

— Geometric_alignment;

— Geometric_intersection;

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— Geometric_tolerance;

— Geometric_tolerance_qualifier;

— Geometric_tolerance_with_applied_material_condition_property;

— Geometric_tolerance_with_referenced_datum_system;

— Geometric_tolerance_without_referenced_datum_system;

— Inter_stratum_feature;

— Limit_dimension_representation;

— Linear_extension;

— Maximum_dimension_representation;

— Minimum_dimension_representation;

— Non_feature_shape_element;

— Opposing_boundary_set_size_characteristic;

— Parallel_shape_element_relationship;

— Parallelism_tolerance;

— Part_feature;

— Perpendicular_shape_element_relationship;

— Perpendicularity_tolerance;

— Physical_component_feature;

— Physical_feature_or_part_template;

— Physical_laminate_component;

— Plus_minus_tolerance_characteristic;

— Plus_minus_tolerance_range_representation;

— Position_tolerance;

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— Position_tolerance_with_referenced_datum_system;

— Position_tolerance_without_referenced_datum_system;

— Positional_boundary;

— Positional_boundary_and_profile_boundary_member_relationship;

— Positional_boundary_definition;

— Positional_boundary_member;

— Positional_boundary_member_definition;

— Positional_boundary_offset;

— Pre_defined_dimension_qualifier;

— Pre_defined_geometric_tolerance_qualifier;

— Profile_boundary_definition;

— Profile_boundary_definition_with_offsets;

— Profile_of_any_line_tolerance;

— Profile_of_any_line_tolerance_with_referenced_datum_system;

— Profile_of_any_line_tolerance_without_referenced_datum_system;

— Profile_of_any_surface_tolerance;

— Profile_of_any_surface_tolerance_with_referenced_datum_system;

— Profile_of_any_surface_tolerance_without_referenced_datum_system;

— Profile_related_positional_boundary;

— Profile_related_positional_boundary_definition;

— Projected_tolerance_zone_definition;

— Projected_zone_and_base_relationship;

— Projected_zone_height_characteristic;

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— Restraint_condition;

— Runout_tolerance_zone_definition_with_specified_angle;

— Runout_tolerance_zone_orienting_relationship;

— Runout_zone_orientation;

— Separate_geometric_tolerance_requirement;

— Shape_dimension_representation;

— Shape_element;

— Shape_element_boundary_relationship;

— Shape_element_composing_relationship;

— Shape_element_constituent_relationship;

— Shape_element_deriving_relationship;

— Shape_element_locating_relationship;

— Shape_element_relationship;

— Simultaneous_geometric_tolerance_requirement;

— Single_boundary_dimension;

— Single_datum;

— Singular_dimension_representation;

— Statistical_dimensional_tolerance;

— Statistical_geometric_tolerance;

— Straightness_tolerance;

— Stratum_feature;

— Symmetry_tolerance;

— Tangent_plane;

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— Tangent_shape_element;

— Theoretically_exact_dimension_representation;

— Tolerance_specific_restraint_condition;

— Tolerance_zone;

— Tolerance_zone_and_viewing_plane_orienting_relationship;

— Tolerance_zone_boundary;

— Tolerance_zone_boundary_definition;

— Tolerance_zone_boundary_member;

— Tolerance_zone_boundary_member_offset;

— Tolerance_zone_circular_or_cylindrical_or_spherical_boundary;

— Tolerance_zone_definition;

— Tolerance_zone_definition_with_per_unit_size_specification;

— Tolerance_zone_definition_with_specified_orientation;

— Tolerance_zone_explicit_opposing_boundary_set;

— Tolerance_zone_form;

— Tolerance_zone_implicit_opposing_boundary_set;

— Tolerance_zone_opposing_boundary_set;

— Tolerance_zone_per_unit_size_specification;

— Total_runout_tolerance;

— True_profile;

— User_defined_dimension_qualifier;

— User_defined_geometric_tolerance_qualifier;

— Viewing_plane;

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— Viewing_plane_based_orientation;

— Viewing_plane_definition.

4.1.51 geometrically_bounded_2d_wireframe

The geometrically_bounded_2d_wireframe UoF defines the information needed to describe the representation of the shape of a product by 2 dimensional wireframes that are defined by geometry. This includes 2D curves.

The following application objects are used by the geometrically_bounded_2d_wireframe UoF:

— geometrically_bounded_2d_wireframe.

4.1.52 inter_stratum_feature_template

The inter_stratum_feature_template UoF defines the information needed to describe product data, including shape data and terminal definitions. Occurrences of this data are used to describe electrical connectivity, and other design relationships, between different layers of an interconnect substrate. This UoF is used in conjunction with manufacturing_technology UoF.

The following application objects are used by the inter_stratum_feature_template UoF:

— Component_termination_passage_template;

— Component_termination_passage_template_interface_terminal;

— Component_termination_passage_template_join_terminal;

— Component_termination_passage_template_terminal;

— Counterbore_passage_template;

— Countersunk_passage_template;

— Inter_stratum_feature_template;

— Unsupported_passage_template;

— Via_template;

— Via_template_terminal.

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4.1.53 interconnect_bill_of_material

The interconnect_bill_of_material UoF defines the information needed to describe the structured list of materials of components required to make an interconnect. The interconnect_bill_of_material UoF includes the vendor supplying the product, all approved alternates and substitutes, and which product selection is dependent on the result of a test.

The following application objects are used by the interconnect_bill_of_material UoF:

— Alternate_product;

— Alternate_select_product;

— Assembly_alternate_product;

— Assembly_composition_relationship;

— Assembly_material_composition_relationship;

— Interconnect_module_stratum_assembly_relationship;

— Material_composition_relationship;

— Next_higher_assembly_relationship;

— Promissory_usage_relationship;

— Substitute_product;

— Test_select_product.

4.1.54 interconnect_component_grouping

The interconnect_component_grouping UoF defines the information needed to describe the different ways of grouping components in an interconnect substrate. The interconnect_component_grouping UoF functionality supports fabricated assemblies. The interconnect_component_grouping UoF functionality supports design reuse of complex design elements.

The following application objects are used by the interconnect_component_grouping UoF:

— Array_placement_group;

— Assembly_group_component;

— Interfaced_group_component;

— Sub_assembly_relationship.

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4.1.55 interconnect_design_information_assignment_to_usage_view

The interconnect_design_information_assignment_to_usage_view UoF defines the information that describes the association between product data necessary for interconnect design and product data necessary to define a usage view of the interconnect.

The following application objects are used by the interconnect_design_information_assignment_to_usage_view UoF:

— Component_feature_to_physical_usage_view_assignment;

— Component_terminal_to_interconnect_module_terminal_assignment;

— Stratum_concept_to_physical_usage_view_assignment.

4.1.56 interconnect_functional_requirement_allocation

The interconnect_functional_requirement_allocation UoF describes the assignment of functional connectivity requirements to an interconnect product under design. The assembly or assemblies for which the interconnect is originally designed to help compose constitutes an optional part of the requirements for the interconnect. The Part_connected_terminals_definition constitutes a definition of the required connections as seen from the exterior of the interconnect. The Physical_node_requirement_to_implementing_component_allocation is for use with Printed_components wherein the total functionality of the interconnect includes complex functionality (e.g., printed filters).

The following application objects are used by the interconnect_functional_requirement_allocation UoF:

— Assembly_module;

— Interconnect_module;

— Part_connected_terminals_definition;

— Physical_node_requirement_to_implementing_component_allocation.

4.1.57 interconnect_interface_component

The interconnect_interface_component UoF defines the information needed to describe the component that acts as a connector that provides external electrical access to an interconnect. The items' position in the interconnect substrate, and the specification that dictates the selection and placement are included.

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The following application objects are used by the interconnect_interface_component UoF:

— Ee_specification;

— Interface_component;

— Printed_connector_component.

4.1.58 interconnect_marking

The interconnect_marking UoF defines the information needed to apply identification information, using material, to an interconnect. The content of the information is under configuration control. The scope of this UoF is for interconnect definitions.

The following application objects are used by the interconnect_marking UoF:

— Configuration_controlled_message;

— Ee_specification;

— Marking.

4.1.59 interconnect_module_connection_routing

The interconnect_module_connection_routing UoF defines the information needed to describe the electrical design requirements for the conductive elements associated with an interconnect substrate. The information contains specific topological requirements data, and user defined property data related to elements associated with the topological requirements data. The information needed to describe the resulting design is included.

EXAMPLE 1 Geometric trace layout data arranged in ordered trees is this type of information.

The following application objects are used by the interconnect_module_connection_routing UoF:

— Connectivity_sub_structure;

— Dependently_located_layer_connection_point;

— Dielectric_crossover_area;

— Explicitly_located_layer_connection_point;

— Fabrication_joint;

— Inter_stratum_join_implementation;

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— Inter_stratum_join_relationship;

— Intra_stratum_join_relationship;

— Join_relationship;

— Junction_vertex_allocation;

— Layer_connection_point;

— Layer_connection_point_link;

— Physical_connectivity_abstraction_map;

— Physical_connectivity_definition;

— Physical_connectivity_definition_relationship;

— Physical_connectivity_element;

— Physical_connectivity_structure_definition;

— Physical_network;

— Physical_network_supporting_inter_stratum_feature;

— Physical_network_supporting_stratum_feature_conductive_join;

— Stratum_concept_relationship;

— Stratum_feature_conductive_join;

— Topological_junction.

4.1.60 interconnect_module_design

The interconnect_module_design UoF defines the information needed to describe the required physical design data for an interconnect substrate. The information includes stackup, conductive patterns, feature tolerances, design intent, interface feature design, plated and unplated passages, various forms of cutout and edge treatments, and traceability capability from design features back to design intent. Various design definitions may exist for the same interconnect module depending on the discipline and enterprise perspective.

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The following application objects are used by the interconnect_module_design UoF:

— Adjacent_stratum_surface_definition;

— Array_placement_group;

— Assembly_component;

— Assembly_composition_relationship;

— Assembly_group_component;

— Blind_via;

— Bonded_conductive_base_blind_via;

— Buried_via;

— Component_based_annotation_symbol_placement_relationship;

— Component_based_annotation_text_relationship;

— Component_external_reference;

— Component_feature;

— Component_feature_external_reference;

— Component_feature_make_from_relationship;

— Component_feature_relationship;

— Component_feature_to_layout_feature_relationship;

— Component_interface_terminal;

— Component_make_from_relationship;

— Component_terminal;

— Component_termination_passage;

— Component_termination_passage_interface_terminal;

— Component_termination_passage_join_terminal;

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— Conductive_filled_area;

— Conductive_interconnect_element;

— Conductive_interconnect_element_terminal;

— Conductive_interconnect_element_with_pre_defined_transitions;

— Conductive_interconnect_element_with_user_defined_single_transition;

— Conductor;

— Connected_filled_area;

— Cutout;

— Cutout_edge_segment;

— Design_layer_stratum;

— Dielectric_material_passage;

— Documentation_layer_stratum;

— Edge_segment_vertex;

— Fabrication_joint;

— Fiducial;

— Fiducial_stratum_feature;

— Frozen_assignment;

— Inter_stratum_extent;

— Inter_stratum_feature;

— Inter_stratum_feature_edge_segment_template;

— Inter_stratum_feature_edge_template;

— Interconnect_module_edge;

— Interconnect_module_edge_segment;

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— Interconnect_module_stratum_assembly_relationship;

— Interconnect_module_stratum_based_terminal;

— Interfacial_connection;

— Internal_probe_access_area;

— Internal_stratum_access;

— Join_two_physical_connectivity_definition_supporting_printed_component;

— Laminate_component;

— Laminate_text_component;

— Laminate_text_string_component;

— Land_interface_terminal;

— Land_join_terminal;

— Layer;

— Next_higher_assembly_relationship;

— Non_conductive_base_blind_via;

— Non_functional_land_interface_terminal;

— Non_functional_land_join_terminal;

— Part_connected_terminals_definition;

— Part_template;

— Partially_plated_cutout;

— Partially_plated_interconnect_module_edge;

— Pcb;

— Physical_connectivity_interrupting_cutout;

— Physical_connectivity_make_from_relationship;

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— Plated_conductive_base_blind_via;

— Plated_cutout;

— Plated_cutout_edge_segment;

— Plated_inter_stratum_feature;

— Plated_interconnect_module_edge;

— Plated_interconnect_module_edge_segment;

— Plated_passage;

— Primary_stratum_indicator_symbol;

— Printed_component;

— Printed_component_join_terminal;

— Printed_connector_component;

— Printed_connector_component_interface_terminal;

— Probe_access_area;

— Promissory_usage_relationship;

— Routed_printed_component;

— Shield;

— Special_symbol_laminate_component;

— Stratum;

— Stratum_average_surface;

— Stratum_feature;

— Stratum_feature_in_stratum_3d_position;

— Stratum_feature_in_stratum_planar_position;

— Stratum_feature_template_component;

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— Stratum_interconnect_module_3d_position;

— Stratum_interconnect_module_planar_position;

— Stratum_make_from_relationship;

— Stratum_surface;

— Sub_assembly_relationship;

— Thermal_component;

— Unsupported_passage;

— Via;

— Via_terminal.

4.1.61 interconnect_module_edge

The interconnect_module_edge UoF defines the information needed to describe the outer edge of the interconnect substrate in a design view.

The following application objects are used by the interconnect_module_edge UoF:

— Edge_segment_vertex;

— Interconnect_module_edge;

— Interconnect_module_edge_segment;

— Partially_plated_interconnect_module_edge;

— Plated_interconnect_module_edge;

— Plated_interconnect_module_edge_segment.

4.1.62 interconnect_module_usage_view

The interconnect_module_usage_view UoF defines the information needed to describe the interface definition of the interconnect substrate. This view may be used for the purpose of simulation and verifying the mechanical fit of the interconnect substrate when installed in the next level of assembly.

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The following application objects are used by the interconnect_module_usage_view UoF:

— Edge_segment_vertex;

— Interconnect_module_edge_segment_surface;

— Interconnect_module_edge_surface;

— Interconnect_module_primary_surface;

— Interconnect_module_secondary_surface;

— Interconnect_module_stratum_based_terminal;

— Interconnect_module_surface_feature;

— Interconnect_module_terminal;

— Interconnect_module_usage_view;

— Located_interconnect_module_thickness_requirement;

— Pcb_usage_view.

4.1.63 interconnect_physical_requirement_allocation

The interconnect_physical_requirement_allocation UoF describes the assignment of customer, regulatory agency, and enterprise requirements to an interconnect product under design. These requirements may be assigned to physical items, geometric features, or conceptual items that are used in various phases of the design process.

The following application objects are used by the interconnect_physical_requirement_allocation UoF:

— Assembly_requirement_allocation;

— Assembly_separation_requirement_allocation;

— Electromagnetic_compatibility_requirement_allocation;

— Interface_component_allocation;

— Requirement_allocation;

— Shield_allocation;

— Specification_allocation;

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— Stratum_technology_line_width_tolerance_assignment;

— Thermal_isolation_requirement_assignment;

— Thermal_requirement_allocation.

4.1.64 interconnect_placement_requirements

The interconnect_placement_requirements UoF defines the information needed to describe the constraints restricting where components are to be placed in an Interconnect_module. These restrictions may be component category to board feature category or component category to component category or board feature category to board feature category related. Data that refers to assembly is included in order to support embedded components only, where those components are assembled during the substrate fabrication process.

The following application objects are used by the interconnect_placement_requirements UoF:

— Component_external_reference;

— Component_feature_external_reference;

— Component_group_assignment;

— Component_placement_restriction_assignment;

— Interconnect_module_component_surface_feature;

— Interconnect_module_constraint_region;

— Item_restricted_requirement_occurrence;

— Layer_qualified_layout_spacing_requirement_occurrence;

— Layout_spacing_requirement_non_conforming_design_object;

— Layout_spacing_requirement_occurrence;

— Mounting_restriction_area;

— Placement_group;

— Placement_group_area_assignment.

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4.1.65 interconnect_shape

The interconnect_shape UoF defines the information needed to describe explicit geometric models used in the design process for an interconnect substrate. This UoF permits the type of geometric representation for a library item to be different than the type of geometric representation of an instance in the design.

The following application objects are used by the interconnect_shape UoF:

— Assembly_component_2d_shape;

— Assembly_component_3d_shape;

— Bond_assembly_position;

— Component_2d_edge_location;

— Component_2d_location;

— Component_3d_location;

— Component_assembly_2d_position;

— Component_assembly_3d_position;

— Component_part_2d_geometric_representation_relationship;

— Component_part_3d_geometric_representation_relationship;

— Consistent_stratum_shape_projection;

— Design_intent_modification_3d_shape;

— Design_intent_modification_in_stratum_3d_position;

— Design_intent_modification_in_stratum_planar_position;

— Design_intent_modification_non_planar_2d_shape;

— Design_intent_modification_planar_shape;

— Design_intent_modification_styled_area_representation;

— Open_shell_based_surface;

— Stratum_3d_shape;

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— Stratum_average_surface_shape;

— Stratum_feature_3d_shape;

— Stratum_feature_non_planar_2d_shape;

— Stratum_feature_planar_shape;

— Stratum_feature_shape_stratum_average_surface_shape_relationship;

— Stratum_feature_shape_stratum_surface_shape_relationship;

— Stratum_feature_styled_area_representation;

— Stratum_planar_shape;

— Stratum_surface_in_stratum_3d_position;

— Stratum_surface_shape.

4.1.66 laminate_assembly_design

The laminate_assembly_design UoF defines the information needed to describe the laminate product resulting from the adjacent surface to surface bonding between laminate components. The usage of Assembly_joint in this UoF is to allow specification of the sequential arrangement of materials.

EXAMPLE 1 This design data may be used during a concurrent engineering process where one side is viewing the design as an arrangement of Stratum in the entire interconnect design and the other side is viewing the design as an arrangement of laminates.

The following application objects are used by the laminate_assembly_design UoF:

— Assembly_joint;

— Interconnect_module;

— Interconnect_module_component;

— Interconnect_module_component_surface_feature;

— Next_higher_assembly_relationship;

— Promissory_usage_relationship.

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4.1.67 land

The land UoF defines the information required to partially specify certain interconnect substrate features. These items are defined to support attachments for mating components in the electronic assembly. The items are not necessarily themselves visually distinguishable in the material in the interconnect substrate.

The following application objects are used by the land UoF:

— Component_termination_passage_and_contact_size_dependent_land;

— Component_termination_passage_and_contact_size_dependent_non_functional_land;

— Component_termination_passage_dependent_land;

— Component_termination_passage_dependent_non_functional_land;

— Contact_size_dependent_land;

— Contact_size_dependent_non_functional_land;

— Land;

— Non_functional_land;

— Unsupported_passage_dependent_non_functional_land;

— Via_and_contact_size_dependent_land;

— Via_and_contact_size_dependent_non_functional_land;

— Via_dependent_land;

— Via_dependent_non_functional_land.

4.1.68 library_item

The library_item UoF defines the information needed to describe the generic items that may be configuration managed at a level appropriate for inclusion in a library. Items in a library are incorporated into many designs without actively tracking which designs incorporate the items. These items are readily available to any enterprise; however, the amount of descriptive information varies between enterprises. The property values may vary between enterprises.

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The following application objects are used by the library_item UoF:

— Library_ee_product_definition;

— Library_item;

— Library_model.

4.1.69 manufacturing_technology

The manufacturing_technology UoF defines the information needed to describe the properties of the fabrication technology selected for the interconnect substrate being designed.

The following application objects are used by the manufacturing_technology UoF:

— Component_termination_passage_template;

— Counterbore_passage_template;

— Countersunk_passage_template;

— Default_attachment_size_and_component_termination_passage_based_land_physical_template;

— Default_attachment_size_and_via_based_land_physical_template;

— Default_attachment_size_based_land_physical_template;

— Default_component_termination_passage_based_land_physical_template;

— Default_component_termination_passage_definition;

— Default_land_physical_template;

— Default_passage_based_land_physical_template;

— Default_unsupported_passage_based_land_physical_template;

— Default_unsupported_passage_definition;

— Default_via_based_land_physical_template;

— Default_via_definition;

— Design_layer_technology;

— Documentation_layer_technology;

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— Fabrication_technology_specification;

— Inter_stratum_feature_template;

— Land_physical_template;

— Land_template_interface_terminal;

— Land_template_join_terminal;

— Land_template_terminal;

— Line_width_class;

— Passage_technology;

— Stratum_technology;

— Unsupported_passage_template;

— Via_template.

4.1.70 material_product

The material_product UoF defines the information needed to describe the materials that compose an item. The association between specific materials used during the manufacturing process of the interconnect substrate are also described, in addition to any components that are part of the interconnect substrate manufacturing process. Material product categories may be described in addition to material properties.

The following application objects are used by the material_product UoF:

— Ee_material;

— Ee_product_category;

— Ee_product_category_relationship;

— Ee_product_related_product_category;

— Material_assembly_relationship;

— Material_composition_relationship.

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4.1.71 non_topological_surface

The non_topological_surface UoF describes the representation of the shape of a product using surface geometry without topology. These representations are formed only by the use of points, curves, and surfaces. The boundaries of the surfaces are defined by curves on the surfaces and by explicit association between curves and surfaces they bound. Surfaces and curves shall be explicitly trimmed unless they are closed.

The following application objects are used by the non_topological_surface UoF:

— Geometrically_bounded_surface.

4.1.72 package

The package UoF defines the information needed to describe the package of a component that is part of the assembly. The shape of the component both as purchased and as delivered to a customer are provided. A common identifier for the shape of the package and placement orientation alignment information between 2 dimensional and 3 dimensional models are also provided. The information needed to allow industry or enterprise groups to populate explicit models and define associated properties and associated categories for standard packages and their versions is provided.

The following application objects are used by the package UoF:

— Altered_package;

— Altered_package_terminal;

— Connection_zone_interface_plane_relationship;

— Fiducial_part_feature;

— Guided_wave_terminal;

— Length_trimmed_terminal;

— Package;

— Package_body;

— Package_body_bottom_surface;

— Package_body_surface;

— Package_body_top_surface;

— Package_terminal;

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— Part_tooling_feature;

— Polarity_indication_feature;

— Primary_orientation_feature;

— Primary_reference_terminal;

— Registered_style;

— Seating_plane;

— Secondary_orientation_feature;

— Shape_formed_terminal;

— Surface_prepped_terminal;

— Wire_terminal.

4.1.73 packaged_part_black_box_model

The packaged_part_black_box_model UoF defines the information necessary to describe a product as a part for the next level of assembly. The inner structure of this part isn't visible by the electronic assembly designer. This UoF defines the information necessary to describe the product terminals that are directly connected for the purposes of normal usage.

EXAMPLE 1 All terminals that are to be connected to a certain power supply voltage may be specified by use of the information defined in this UoF.

NOTE When an enterprise designs a part specifically for use on an electronic assembly, this allows the designer of the electronic assembly to have just enough information to use that part, like any other part, in the design process of the electronic assembly.

The following application objects are used by the packaged_part_black_box_model UoF:

— Altered_packaged_part;

— Packaged_connector;

— Packaged_connector_terminal_relationship;

— Packaged_part;

— Packaged_part_interface_terminal;

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— Packaged_part_join_terminal;

— Packaged_part_terminal;

— Part_connected_terminals_definition.

4.1.74 packaged_part_terminal_analytical_representation

The packaged_part_terminal_analytical_representation UoF defines the information needed to associate unique behavioural data for each specific terminal to support computer-based experimentation that explicitly includes terminal effects. The specific context of this UoF is that the individual terminal is treated as a separate model for analysis purposes. Each Application object type referenced in this UoF is allocating the analysis port to the external feature or is allocating the analysis port to the internal feature. Each discipline may have a different analytical representation of a product design. For higher fidelity, reference the connection_zone_to_analytical_model_port_mapping UoF or a datum_difference related UoF since those UoFs more detailed modeling capabilities.

NOTE This UoF is only appropriate in the context of a so-called white box model.

The following application objects are used by the packaged_part_terminal_analytical_representation UoF:

— Part_device_terminal_model_port_assignment;

— Part_feature_model_port_assignment.

4.1.75 packaged_part_white_box_model

The packaged_part_white_box_model UoF defines the information necessary to describe a product for use by analysts for evaluation of properties as part of the next level of assembly. Some portion of the inner structure of the part is visible by analysts. Users may define properties at a level of accuracy required to support enterprise or standard analysis requirements.

NOTE This capability is typically used where the packaged parts are complex and are also primary sources of assembly failures. This information is not a description of multi-level hierarchical design definitions. This information may be used where off-the-shelf products are used where only critical information is conveyed.

EXAMPLE 1 The use of this information for analyzing purchased MCMs is typical.

The following application objects are used by the packaged_part_white_box_model UoF:

— Connection_zone_interface_plane_relationship;

— Connection_zone_model_port_assignment;

— Device_2d_position;

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— Device_3d_position;

— Device_terminal_map;

— Device_terminal_map_relationship;

— Packaged_connector_terminal_relationship;

— Packaged_part;

— Packaged_part_interface_terminal;

— Packaged_part_join_terminal;

— Part_connected_terminals_definition;

— Part_device;

— Part_device_terminal;

— Part_device_terminal_model_port_assignment;

— Part_feature_model_port_assignment.

4.1.76 part_feature

The part_feature UoF defines the information needed to describe the distinctive aspects of separately manufactured products included in the design. Explicit models of the aspects may be combined in the explicit model for the products. Classification of feature functionality is supported, with several predefined functions provided.

The following application objects are used by the part_feature UoF:

— Edge_segment_vertex;

— Feature_group_relationship;

— Fiducial_part_feature;

— Interconnect_module_edge_segment_surface;

— Interconnect_module_edge_surface;

— Interconnect_module_primary_surface;

— Interconnect_module_secondary_surface;

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— Interconnect_module_surface_feature;

— Part_array_feature;

— Part_feature;

— Part_group_feature;

— Part_mounting_feature;

— Part_terminal;

— Part_tooling_feature;

— Polarity_indication_feature;

— Primary_orientation_feature;

— Primary_reference_terminal;

— Secondary_orientation_feature;

— Thermal_feature;

— Usage_concept_usage_relationship.

4.1.77 part_feature_to_analytical_model_port_mapping

The part_feature_to_analytical_model_port_assignment UoF defines the information needed to associate a specific feature of a physical unit with an analytical model port to support computer-based experimentation. The consequence is that the UoF defines the information needed to associated a physical unit with a specific behaviour.

The following application objects are used by the part_feature_to_analytical_model_port_mapping UoF:

— Analytical_representation;

— Part_feature_model_port_assignment.

4.1.78 part_template

The part_template UoF defines the information necessary to describe the different types of templates. These templates provide the shape and other property information for the feature to be used in the design of the interconnect substrate.

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The following application objects are used by the part_template UoF:

— Default_trace_template;

— Material_addition_feature_template;

— Material_removal_feature_template;

— Part_template;

— Part_text_template;

— Special_symbol_part_template;

— Stratum_feature_template;

— Trace_template;

— Usage_concept_usage_relationship.

4.1.79 part_template_shape

The part_template_shape UoF defines the information needed to describe explicit geometric models used as templates in the design process for an electronic assembly or for an interconnect substrate. This UoF defines the information needed to associate the 2 dimensional and 3 dimensional geometric representation of the layout templates in order to state that they are consistent.

The following application objects are used by the part_template_shape UoF:

— Consistent_part_template_shape_projection;

— Part_template_3d_shape;

— Part_template_non_planar_2d_shape;

— Part_template_planar_shape.

4.1.80 physical_network

The physical_network UoF defines the information needed to describe the internal topological definition used as an explicit requirement in the design of the interconnect substrate. This internal topological definition is a result of mapping the external connection requirements defined in the interconnect_functional_requirement_allocation UoF to the interconnect design view.

The following application objects are used by the physical_network UoF:

— Physical_network.

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4.1.81 physical_unit

The physical_unit UoF defines the information necessary to describe a product that may be an electronic assembly, or be used in an electronic assembly, or be used in the design of an electronic assembly. The physical_unit UoF defines the information necessary to describe a product that may be an interconnect product, or be used in an interconnect product, or be used in the design of an interconnect product. The information shall at least describe how the product may be used as a component but, may also encompass all the information required to reproduce the item. The information may also include information necessary to categorize the product or product versions for part selection activities. The information may also include information for parts that are purely mechanical in function.

The following application objects are used by the physical_unit UoF:

— Ee_product_category;

— Ee_product_category_relationship;

— Ee_product_related_product_category;

— Ee_product_specific_parameter_value_assignment;

— Physical_unit;

— Physical_unit_design_view;

— Physical_unit_relationship;

— Physical_unit_usage_view;

— Technology;

— Usage_concept_usage_relationship.

4.1.82 physical_unit_analytical_representation

The physical_unit_analytical_representation UoF defines the information needed to associate specific data for a physical unit with an analytical model to support computer-based experimentation. Each discipline may have a different physical unit analytical representation. Direct specification of the mapping to a connection area on the terminal of the product concepts under investigation is provided.

The following application objects are used by the physical_unit_analytical_representation UoF:

— Analytical_representation;

— Connection_zone_model_port_assignment;

— Part_feature_model_port_assignment.

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4.1.83 physical_unit_shape

The physical_unit_shape UoF defines the information needed to describe explicit geometric models used in the design process for an electronic assembly or for an interconnect substrate. This UoF permits different types of geometric representation for the shape of the physical units and synchronization of the shapes with different dimensionality.

The following application objects are used by the physical_unit_shape UoF:

— Consistent_physical_unit_shape_projection;

— Physical_unit_3d_shape;

— Physical_unit_planar_shape.

4.1.84 planned_characteristic

The planned_characteristic UoF defines the information that captures design intent properties. This design intent is based upon the manufacturing capabilities, product design structure, and component characteristics. This UoF defines the information that captures properties that are the result of experimental evaluation of the product definition in the product's intended use or in a manufacturing environment.

The following application objects are used by the planned_characteristic UoF:

— Evaluated_characteristic;

— Planned_characteristic.

4.1.85 planned_effectivity

The planned_effectivity UoF defines the information needed to describe under what circumstances a configuration change is to occur. The effectivity may be based on either the manufacturing cycle, or a time period, or a given quantity, or a range of individual products.

EXAMPLE 1 A planned-effectivity would be the time period between two dates.

The following application objects are used by the planned_effectivity UoF:

— Planned_date_effectivity;

— Planned_effectivity;

— Planned_lot_effectivity;

— Planned_serial_number_effectivity.

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4.1.86 printed_part_template

The printed_part_template UoF defines the information needed to describe the definition of a printed component. Support is provided for both microwave and non-microwave design. Functionality is assigned in the definition. This UoF defines the information needed to describe the terminals that are directly connected internally in the printed component.

The following application objects are used by the printed_part_template UoF:

— Printed_connector_template;

— Printed_connector_template_terminal_relationship;

— Printed_part_cross_section_template;

— Printed_part_cross_section_template_terminal;

— Printed_part_template;

— Printed_part_template_connected_terminals_definition;

— Printed_part_template_interface_terminal;

— Printed_part_template_join_terminal;

— Printed_part_template_material;

— Printed_part_template_terminal;

— Printed_part_template_terminal_relationship;

— Usage_concept_usage_relationship.

4.1.87 product_identification

The product_identification UoF describes the structure through which a product, product categories, unique versions of a product, and different design discipline views of a product may be defined. This part of ISO 10303 does not rely solely on the relationship between design discipline view of a product and the product version to establish relationships between design discipline views but provides explicit models of the desired relationships in order to meet domain requirements(e.g., one functional product model may define the functionality of many physical products).

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The following application objects are used by the product_identification UoF:

— Ee_product;

— Ee_product_category;

— Ee_product_category_relationship;

— Ee_product_definition;

— Ee_product_related_product_category;

— Ee_product_specific_parameter_value_assignment;

— Ee_product_version;

— Externally_defined_ee_product_definition;

— Product_association.

4.1.88 product_requirement_allocation

The product_requirement_allocation UoF describes the assignment of customer, regulatory agency, and enterprise requirements to a product. These requirements may be assigned to products or configuration items or product versions in various phases of the design process.

The following application objects are used by the product_requirement_allocation UoF:

— Requirement_allocation.

4.1.89 product_rule

The product_rule UoF defines the information needed to describe design constraints, commonly referred to as rules. The information describes the rule's relationship to product characteristics, formal description of the functions that embody the rule, in addition to the configuration management aspects applied to the rule. The configuration management information supports rule version control and supports a formal process to making changes to an existing rule.

The following application objects are used by the product_rule UoF:

— Ee_rule;

— Ee_rule_complex_clause;

— Ee_rule_conclusion_definition;

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— Ee_rule_definition;

— Ee_rule_function;

— Ee_rule_premise_definition;

— Ee_rule_simple_clause;

— Ee_rule_version;

— Participant_date_and_time_assignment;

— Rule_action;

— Rule_adoption;

— Rule_change_request;

— Rule_creation;

— Rule_expiration;

— Rule_justification;

— Rule_modification;

— Rule_priority;

— Rule_rejection;

— Rule_request;

— Rule_set;

— Rule_set_group;

— Rule_submission;

— Rule_supersedence.

4.1.90 requirement_decomposition

The requirement_decomposition UoF defines the information needed to describe the structure of a requirement, including any explicit combinatorial relationship between requirements helping to compose a requirement, and any dependencies upon other requirements.

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The following application objects are used by the requirement_decomposition UoF:

— Constraint_occurrence;

— Design_characteristic_occurrence;

— Design_requirement_occurrence;

— Ee_requirement_occurrence;

— Electrical_requirement_occurrence;

— Electromagnetic_requirement_occurrence;

— Material_electrical_conductivity_requirement_occurrence;

— Operational_requirement_occurrence_relationship;

— Part_based_constraint_occurrence;

— Purpose_occurrence;

— Requirement_composition;

— Requirement_group_occurrence;

— Thermal_requirement_occurrence.

4.1.91 sequential_laminate_assembly_design

The sequential_laminate_assembly_design UoF defines the information needed to describe the laminate product resulting from the adjacent surface to surface bonding between laminate components. The sequential_laminate_assembly_design UoF also defines the information needed to describe a multi-layer connection in the laminate assembly where the layers are not adjacent. This description uses Interconnect_module, Interconnect_module_component_stratum_based_terminal, and Interconnect_module_product_assembly_view_fabrication_joint.

EXAMPLE 1 This design data may be used during a concurrent engineering process where one side is viewing the design as an arrangement of Stratum in the entire interconnect design and the other side is viewing the design as an arrangement of laminates.

EXAMPLE 2 This design data may be used during a concurrent engineering process where one side is viewing the design as the entire interconnect substrate, and the other side is viewing only the data required to determine the connections at one level of laminate assembly. Since the bonds in the laminate assembly are associated with occurrences of Interconnect_module_stratum_based_terminal, the enterprise responsible for the entire design may populate Part_connected_terminals_definition from the functional_specification UoF to define to the lower level design team the required connectivity for the laminate assembly at the lower level.

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NOTE Fabrication technology capability will limit the number of lower level bonds actually associated to each Interconnect_module_product_assembly_view_fabrication_joint, but this part of ISO 10303 does not preclude any specific fabrication technology. Cutout and other Inter_stratum_feature are not within the scope of the sequential_-laminate_assembly_design UoF as they directly depend on Stratum which is not included in this UoF.

The following application objects are used by the sequential_laminate_assembly_design UoF:

— Assembly_material_composition_relationship;

— Interconnect_module;

— Interconnect_module_component;

— Interconnect_module_component_stratum_based_terminal;

— Interconnect_module_component_surface_feature;

— Interconnect_module_product_assembly_view_fabrication_joint;

— Interconnect_module_stratum_based_terminal;

— Next_higher_assembly_relationship;

— Promissory_usage_relationship.

4.1.92 shape

The shape UoF defines the information needed to describe explicit geometric models used in the design process for an electronic assembly or for an interconnect substrate.

The following application objects are used by the shape UoF:

— Axis_placement;

— Axis_placement_2d;

— Axis_placement_3d;

— B_rep_2d;

— Boolean_csg_result;

— Bound_volume_shape;

— Bounding_curve;

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— Cartesian_coordinate_system;

— Cartesian_point;

— Cartesian_transformation_operator_2d;

— Closed_curve;

— Composite_curve;

— Composite_curve_segment;

— Connection_zone;

— Curve;

— Externally_defined_hatch_style;

— Externally_defined_tile;

— Externally_defined_tile_style;

— Feature_shape_composition_relationship;

— Feature_shape_definition;

— Feature_shape_occurrence;

— Fill_area;

— Fill_area_occurrence;

— Fill_area_style;

— Fill_area_style_hatching;

— Fill_area_style_tile;

— Fill_area_style_tile_curve_with_style;

— Fill_area_style_tile_solid_region;

— Fill_area_style_tile_symbol_with_style;

— Orientation;

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— Planar_projected_shape;

— Planar_shape;

— Positive_ratio_measure;

— Solid_fill_style;

— Trimmed_line;

— Vector;

— Volume_shape_projection.

4.1.93 signal

The signal UoF defines the information needed to describe properties of an electrical physical phenomenon. This physical phenomenon property may be a simple instance or a composition of many simple instances.

The following application objects are used by the signal UoF:

— Composite_signal_property;

— Composite_signal_property_relationship;

— Representation;

— Signal;

— Signal_property.

4.1.94 solid_of_linear_extrusion

The solid_of_linear_extrusion UoF defines the information needed to describe a volumetric shape defined through the process of sweeping a planar surface over a specified distance.

The following application objects are used by the solid_of_linear_extrusion UoF:

— Solid_of_linear_extrusion.

4.1.95 source_control

The source_control UoF defines the information needed to describe an organization that is qualified to produce a particular product.

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The following application objects are used by the source_control UoF:

— Certification;

— Organization;

— Supplied_product_version.

4.1.96 stratum

The stratum UoF defines the information needed to describe the individual layers of the interconnect substrate as they occur in the design definition. Various design definitions may exist for the same interconnect substrate, depending on the discipline and enterprise perspective.

The following application objects are used by the stratum UoF:

— Design_layer_stratum;

— Documentation_layer_stratum;

— Layer;

— Stratum;

— Stratum_average_surface;

— Stratum_surface;

— Stratum_technology.

4.1.97 stratum_feature

The stratum_feature UoF defines the information needed to describe the geometric shape of material features used to compose each stratum in an interconnect substrate. Location information is included in the description, in addition to the association to constraints placed upon the design. The stratum feature UoF defines the information needed to describe the sequentially ordered changes from an original or base-line feature design intent to a present feature design. Changes in feature material, either removal or addition, may be described, in addition to the nature of the requirement for the feature modification, either for electrical of thermal isolation. Design intent priority may be assigned to stratum features to constrain the extent of changes.

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The following application objects are used by the stratum_feature UoF:

— Design_intent_modification;

— Design_intent_modification_in_stratum_3d_position;

— Design_intent_modification_in_stratum_planar_position;

— Design_intent_modification_sequence;

— Electrical_isolation_removal_structure;

— Filled_area_material_removal_structure;

— Material_addition_feature;

— Material_removal_feature;

— Material_shape_modification;

— Stratum_feature;

— Stratum_feature_in_stratum_3d_position;

— Stratum_feature_in_stratum_planar_position;

— Thermal_isolation_removal_structure.

4.1.98 stratum_position

The stratum_position UoF defines the information needed to describe where the stratum is located and its orientation with respect to the coordinate system of the interconnect substrate. The position supports either a three-dimensional coordinate system or a two-dimensional coordinate system.

The following application objects are used by the stratum_position UoF:

— Adjacent_stratum_surface_definition;

— Interconnect_module_stratum_assembly_relationship;

— Stratum_interconnect_module_3d_position;

— Stratum_interconnect_module_planar_position.

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4.1.99 styled_curve

The styled_curve UoF defines the information needed to describe the geometric properties of material as constrained by a shape. The shape information included is parametric, and path based, rather than an explicit closed curve model.

The following application objects are used by the styled_curve UoF:

— Curve_style;

— Curve_style_font;

— Curve_style_font_and_scaling;

— Externally_defined_curve_font;

— Solid_curve;

— Styled_curve_occurrence.

4.1.100 styled_text

The styled_text UoF defines the information needed to describe the appearance of material included in an interconnect substrate for conveying textual information to the reader.

The following application objects are used by the styled_text UoF:

— Font_definition;

— Registered_font;

— Styled_text.

4.1.101 test_probe

The test_probe UoF defines the information needed to describe the shape and location of a feature that is used to facilitate functional testing and analysis of an electronic assembly, or an interconnect substrate.

The following application objects are used by the test_probe UoF:

— Internal_probe_access_area;

— Probe_access_area.

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4.1.102 wireframe_2d_model_with_topology

The wireframe_2d_model_with_topology UoF defines the information needed to describe the representation of the shape of a product by wireframes in 2 dimensions that are defined by edge or shell topology. This includes 2D curves and topology.

The following application objects are used by the wireframe_2d_model_with_topology UoF:

— Edge_based_2d_wireframe;

— Shell_based_2d_wireframe.

4.1.103 wireframe_with_topology

The wireframe_with_topology UoF defines the information needed to describe the representation of the shape of a product by wireframes that are defined by edge or shell topology. This includes 3D curves and topology.

The following application objects are used by the wireframe_with_topology UoF:

— Edge_based_wireframe;

— Shell_based_wireframe.

4.2 Application objects

This subclause specifies the application objects for the electronic assembly, interconnet, and packaging design 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.

NOTE 1 This part of ISO 10303 describes the constraints on an application object in this clause in a form meant for domain users. Some of the constraints on an application objects are restated in clause 4.3 in a form meant for application developers.

NOTE 2 The syntax "application_object.name" represents the identifier for the attribute of the specified application object.

NOTE 3 The application objects may be related to other application objects by type relations, under constraints defined in the application object. If the relationships to other application objects exist, the application object should be treated a part of an instance network where the rest of the network constrains the application object being considered.

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4.2.1 Add_design_object_management_relationship

An Add_design_object_management_relationship is a type of Design_object_management_relationship (see 4.2.238).

NOTE Together with Change_design_object_management_relationship and Delete_design_object_management_relationship, Add_design_object_management_relationship supports the exchange of changes to a design by the use of a data set containing only (1) the information necessary to identify the design (e.g., an Ee_product_definition or an Ee_product_version), which is assumed to be already known to the receiving system, and (2) the design objects that have been added, changed, or deleted. Note that all the quality and structural requirements defined in this part of ISO 10303 may also apply to the resultant new design iteration.

The data associated with an Add_design_object_management_relationship are the following:

— current_design_object.

4.2.1.1 current_design_object

The current_design_object specifies the role of the Managed_design_object (see 4.2.431) for the Add_design_object_management_relationship.

Constraints:

UR1: The combination of the current_design inherited from the supertype Design_object_management_relationship and the current_design_object shall be unique within a population of Add_design_object_management_relationship.

4.2.2 Adjacent_stratum_surface_definition

An Adjacent_stratum_surface_definition is a type of Managed_design_object (see 4.2.431). An Adjacent_stratum_surface_definition is a link in a sequence of stratum surfaces that result in the completed design. There may be multiple Adjacent_stratum_surface_definition that reference the same stratum surface in the case where Stratum (see 4.2.677) are laterally adjacent. The use of Adjacent_stratum_surface_definition in combination with the position in 2D space of the Stratum within the interconnect is sufficient to uniquely identify the 3D location of the Stratum.

The data associated with an Adjacent_stratum_surface_definition are the following:

— name;

— precedent_surface;

— subsequent_surface.

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4.2.2.1 name

The name specifies the string for the human-interpretable identifier for the Adjacent_stratum_surface_definition.

4.2.2.2 precedent_surface

The precedent_surface specifies the previous Stratum_surface (see 4.2.699) for the Adjacent_stratum_surface_definition.

4.2.2.3 subsequent_surface

The subsequent_surface specifies the subsequent Stratum_surface (see 4.2.699) for the Adjacent_stratum_surface_definition.

Constraints:

UR1: The name shall be unique with a population of Adjacent_stratum_surface_definition.

UR2: The combination of the precedent_surface and the subsequent_surface shall be unique within a population of Adjacent_stratum_surface_definition.

WR1: The precedent_surface shall be a secondary surface of a Stratum.

WR2: The subsequent_surface shall be a primary surface of a Stratum.

4.2.3 Advanced_b_rep

An Advanced_b_rep is a type of Bound_volume_shape (see 4.2.58) 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 curves and surfaces and the topology that binds them. Boundaries are explicitly defined only by topology. All of the geometry that defines the shape of a part or an aspect of the shape of a part must be associated with topology.

4.2.4 Aggregate_connectivity_requirement

An Aggregate_connectivity_requirement is a type of Managed_design_object (see 4.2.431). An Aggregate_connectivity_requirement is the association between a set of one or more Functional_unit_network_node_definition (see 4.2.340) and one Design_composition_path (see 4.2.223) that ensures that the requirement for connectivity is maintained between the functional and the physical designs.

The data associated with an Aggregate_connectivity_requirement are the following:

— connectivity_requirement;

— design_definition_path.

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4.2.4.1 connectivity_requirement

The connectivity_requirement specifies the role of the Functional_unit_network_node_definition (see 4.2.340) for the Aggregate_connectivity_requirement.

4.2.4.2 design_definition_path

The design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Aggregate_connectivity_requirement.

Constraints:

UR1: The design_definition_path shall be unique within a population of Aggregate_connectivity_requirements.

WR1: Each of the terminals that participate in a connectivity_requirement shall be reachable from any other terminal in the design_definition_path that is specified by the same connectivity_requirement.

NOTE Since the hierarchical product structure is represented in this part of ISO 10303 as a directed acyclic graph, the closure requirement is evaluated by traversing the combined graph including both product structure and nodal representation. There is an individual nodal representation for each node or level of the product structure.

4.2.5 Altered_package

An Altered_package is a type of Package (see 4.2.466). An Altered_package describes a Package that has been modified in some manner from a reference Package. The material or shape properties of the Altered_packaged are different from the reference Package.

EXAMPLE 1 Examples of alteration include trimming of the terminals, prebending of the terminals, tinning of the terminals for solderability, or more than one of these.

EXAMPLE 2 Figure 2 illustrates some of the different forms a package may take when it is installed into an assembly. The original form on the left is in the role of to_be_altered for the forms on the right. The altered forms are identified and tracked by an enterprise.

NOTE Most Altered_packages are a result of terminal alteration.

The data associated with an Altered_package are the following:

— package_to_be_altered.

4.2.5.1 package_to_be_altered

The package_to_be_altered specifies the Package (see 4.2.466) that is a reference for the Altered_package.

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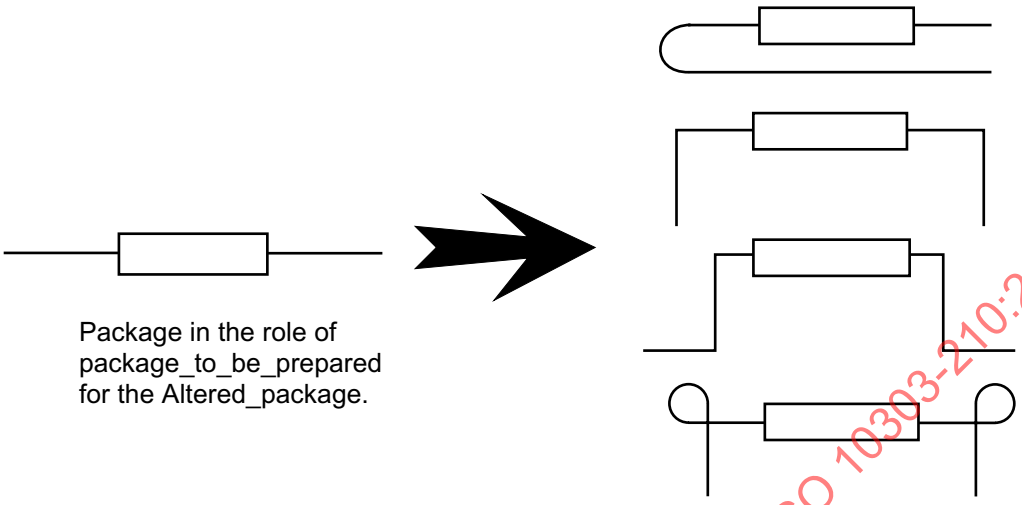

Figure 2 – Altered_package

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Constraints:

WR1: A Package shall not be in the role of package_to_be_altered for itself.

4.2.6 Altered_package_terminal

An Altered_package_terminal is a type of Package_terminal (see 4.2.472). An Altered_package_terminal is one or more of a Length_trimmed_terminal (see 4.2.423), a Shape_formed_terminal (see 4.2.652), or a Surface_prepped_terminal (see 4.2.711). An Altered_package_terminal describes a Package_terminal that is the result of a modification process. Material or shape properties are different from the reference terminal.

EXAMPLE 1 The modification process may be performed prior to installing the occurrence of the Packaged_part (see 4.2.481) onto a Printed circuit board.

The data associated with an Altered_package_terminal are the following:

— associated_definition;

— terminal_to_be_altered.

4.2.6.1 associated_definition

The associated_definition specifies the role of the Altered_package (see 4.2.5) for the Altered_package_terminal.

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4.2.6.2 terminal_to_be_altered

The terminal_to_be_altered specifies the Package_terminal (see 4.2.472) that will be modified for the Altered_package_terminal.

Constraints:

WR1: A Package_terminal shall not be in the role of terminal_to_be_altered for itself either directly or indirectly.

4.2.7 Altered_packaged_part

An Altered_packaged_part is a type of Packaged_part (see 4.2.481) whose used_package is an Altered_package (see 4.2.5). The material or shape properties are different from the reference Packaged_part.

NOTE For packaged parts that may have several alternate configurations (e.g., different lead configurations), an "unaltered" configuration can be designated using the base_packaged_part attribute. This base_packaged_part is then referenced by each Altered_packaged_part, along with the used_package, which references the Altered_package for that Altered_packaged_part. This relationship supports the traceability of altered parts, as well as the capability to readily identify potential replacement parts if a specific, altered part is out of stock, for example.

The data associated with an Altered_packaged_part are the following:

— base_packaged_part;

— used_package.

4.2.7.1 base_packaged_part

The base_packaged_part specifies the original, unmodified, Packaged_part (see 4.2.481) for the Altered_packaged_part.

4.2.7.2 used_package

The used_package specifies the Altered_package (see 4.2.5) that is the result of preparing the Package (see 4.2.466) by the enterprise for the Altered_packaged_part.

Constraints:

WR1: The Package in the role of used_package for the Packaged_part in the role of base_packaged_part shall be the same Package as the Package in the role of package_to_be_prepared for the Altered_package in the role of used_package.

WR2: A Packaged_part shall not be a base_packaged_part for itself, either directly or indirectly.

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NOTE 1 This is a conceptual description only. It is understood that an enterprise does not disassemble a packaged part to accomplish its preparation. The view taken is that the package is the only item modified.

NOTE 2 It is recommended to use Engineering_make_from (see 4.2.299) For functional modifications (e.g., re-programming).

4.2.8 Alternate_product

An Alternate_product is a type of Alternate_select_product (see 4.2.9) that is completely interchangeable with a specified Ee_product (see 4.2.274) with respect to form, fit, and function for an enterprise.

The data associated with an Alternate_product are the following:

— defined_alternate_product.

4.2.8.1 defined_alternate_product

The defined_alternate_product specifies the role of the Ee_product (see 4.2.274) for the Alternate_product.

4.2.9 Alternate_select_product

An Alternate_select_product is a type of Managed_design_object (see 4.2.431). An Alternate_select_product is one of an Alternate_product (see 4.2.8), an Assembly_alternate_product (see 4.2.25), or a Test_select_product (see 4.2.720). An Alternate_select_product specifies interchangeability relations at the product level. Form, fit and function evaluation by an enterprise is used to inform the decision to establish the relationship.

The data associated with an Alternate_select_product are the following:

— authorizing_agreement;

— defined_alternate_product;

— defining_base_product.

4.2.9.1 authorizing_agreement

The authorizing_agreement specifies the Contract (see 4.2.159) under which the Ee_product (see 4.2.274) was designed and procured for the Alternate_select_product. The authorizing_agreement need not be specified for a particular Alternate_select_product.

4.2.9.2 defined_alternate_product

The defined_alternate_product specifies one role of the Ee_product (see 4.2.274) for the Alternate_select_product. There shall be one or more Ee_product for the Alternate_select_product.

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4.2.9.3 defining_base_product

The defining_base_product specifies one role of the Ee_product (see 4.2.274) for the Alternate_select_-product. The defining_base_product is the reference with respect to form, fit, and function.

4.2.10 Analytical_model

An Analytical_model is a type of Managed_design_object (see 4.2.431) that provides a mathematical description of the properties of a system. An Analytical_model may be a Library_model (see 4.2.426). An enterprise that controls Analytical_model as a product for configuration management purposes may use Library_model.

NOTE 1 In this part of ISO 10303 an Analytical_model includes the variable declarations of the mathematical description but may not include the assignment of actual values for the variables declared.

NOTE 2 This part of ISO 10303 provides support for computer systems to verify type consistency between product data defined in this part of ISO 10303 and product data captured by Analytical_models.

NOTE 3 This part of ISO 10303 describes the interfaces (ports) to an Analytical_model and provides support for type checking of the units used for the parameters that may be assigned values for an Analytical_model.

EXAMPLE 1 Figure 3 is an example of the case where actual values are not included: the Analytical_model for a resistor that is coded in pseudocode.

When the Analytical_model is referenced by an Analytical_representation (see 4.2.16), literals will be supplied for items declared in the interface; both connections and their parameters, and the simulator must ensure that types are compatible.

NOTE 4 Usually the system is exercised in experiments to evaluate the usefulness of the system in the intended application.

NOTE 5 The language, syntax, and internal semantics of an Analytical_model are not specified by this part of ISO 10303.

NOTE 6 This part of ISO 10303 provides complete support for exchange of units, including SI units, derived units, and user declared units.

NOTE 7 This part of ISO 10303 provides complete support for prefixes of units.

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```
Begin Interface declaration:
name := resistor;
ports{ } := (port 1, port 2};
parameter 1 name := resistance;
parameter 1 units := ohms;
End Interface declaration
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
representation_language := "a simulation language definition document"
reference_document := some external definition

(* the following literals would be defined in the representation _language
current,
voltage,
units,
prefix,
:=
:=:
*
-
*
Ohms may be predefined or not, as required by the users of the language
In any case, it will be defined in the representation_language
or in the reference_document. *)

Model behavior declaration

I(input) :=: -I(output) {constraint based on conservation law}
V := V(input) - V(output)  {constraint based on conservation law}
R := resistance  {name mapping}
V := I(input) * R  {statement of Ohm's Law, the constitutive equation for
    this  analytical_model}
```

Figure 3 – Analytical_model of a resistor

The data associated with an Analytical_model are the following:

— access_mechanism;

— name;

— parameter;

— reference_document;

— representation_language;

— source_code.

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4.2.10.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Analytical_model is dependent on the existence of the Analytical_model_port (see 4.2.11) that specifies the Analytical_model as its accessed_analytical_model. There shall be one or more Analytical_model_port for an Analytical_model.

4.2.10.2 name

The name specifies the string that is the identifier for the Analytical_model.

4.2.10.3 parameter

The parameter specifies the role of the Model_parameter (see 4.2.451) for the Analytical_model. There shall be one or more Model_parameter for a particular Analytical_model. Figure 3 illustrates the use of parameters.

4.2.10.4 reference_document

The reference_document specifies the role of the Ee_document (see 4.2.271) for the Analytical_model. The reference_document includes interface specifications for Analytical_models of interest to the enterprise.

4.2.10.5 representation_language

The representation_language specifies the Language_reference_manual (see 4.2.414) that defines the semantics and syntax of the computer interpretable strings in which the Analytical_model will be encoded. Figure 3 illustrates how the representation_language is specified and coded.

NOTE Only representation_languages that use characters from the ASCII code are supported by this part of ISO 10303.

4.2.10.6 source_code

The source_code specifies the role of the Ee_specification (see 4.2.292) for an Analytical_model. The source_code contains the source code for the Analytical_model. Figure3 illustrates how a source_code is specified and coded.

Constraints:

UR1: The name shall be unique within a population of Analytical_model.

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4.2.11 Analytical_model_port

An Analytical_model_port is a type of Managed_design_object (see 4.2.431). An Analytical_model_-port may be an Analytical_model_scalar_port (see 4.2.13) or an Analytical_model_vector_port (see 4.2.14), or additionally may be a Digital_analytical_model_port (see 4.2.248). An Analytical_model_-port describes an interface point for an Analytical_model (see 4.2.10).

NOTE These points are the points at which a simulator allows a user to stimulate an instance of an Analytical_-model or to evaluate the response of an instance of an Analytical_model to a stimulus in an experiment. In this context, instance includes the reference to the Analytical_model and the literals required for the parameters. A simulator that enforces conservative laws enforces that the energy entering an instance of an Analytical_model must be the same as that leaving the instance of the Analytical_model. The structure of the port is not visible merely by accessing this information. The subtypes of this object provide more visibility into the underlying structure as appropriate. Members of the subtype tree of this object are populated as needed by an application in order to disclose the appropriate level of detail. The specialization in the subtypes of this object occur as a result of being more specific about certain properties of the port.

The data associated with an Analytical_model_port are the following:

— accessed_analytical_model;

— distributed_properties;

— nominal_signal_flow_direction;

— port_name;

— port_type;

— unit_of_measure.

4.2.11.1 accessed_analytical_model

The accessed_analytical_model specifies the Analytical_model (see 4.2.10) that contains this Analytical_model_port.

NOTE 1 Containment in this case explicitly states that if a member of Analytical_model is deleted from the information base then the members of Analytical_model_port that are contained in that member of Analytical_-model are also deleted.

NOTE 2 Containment in this case also explicitly states that the visibility of the name of an Analytical_model_-port is limited to the Analytical_model that is the accessed_analytical_model.

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4.2.11.2 distributed_properties

The distributed_properties specifies that the properties are either a distributed or a lumped element approximation for the Analytical_model_port. A value of TRUE means that the properties are distributed for the Analytical_model_port. A value of FALSE means that the properties are not distributed.

NOTE Multiple modes should be handled by assigning each mode a different port.

4.2.11.3 nominal_signal_flow_direction

The nominal_signal_flow_direction specifies either BIDIRECTIONAL, INPUT_DIRECTION, NOT_APPLICABLE, OUTPUT_DIRECTION, or UNKNOWN_DIRECTION for the Analytical_model_port. The nominal_signal_flow_direction need not be specified for a particular Analytical_model_port.

4.2.11.4 port_name

The port_name specifies the string that represents an identifier, understandable by the end user, for this Analytical_model_port.

NOTE The port_name is documented in the reference_document for the Analytical_model (see 4.2.10).

4.2.11.5 port_type

The port_type specifies one of a boolean_property_type, a logical_property_type, a physical_property_type, or a string_property_type for this Analytical_model_port.

4.2.11.6 unit_of_measure

The unit_of_measure specifies the string for the descriptive label for the unit of measure of the value of a property associated with the simulated physical phenomenon exchanged through a member of the Analytical_model_port. The unit_of_measure need not be specified for a particular Analytical_model_port. The representation of the unit_of_measure is in accordance with ISO 10303-41.

Constraints:

UR1: The combination of the port_name and the accessed_analytical_model shall be unique within a population of Analytical_model_port.

4.2.12 Analytical_model_port_assignment

An Analytical_model_port_assignment is a type of Managed_design_object (see 4.2.431). An Analytical_model_port_assignment is the relationship between a Scalar_terminal_definition (see 4.2.639) and an Analytical_model_port (see 4.2.11) for the purpose of conducting analyses of the design. An Analytical_model_port_assignment binds or associates a behavioural representation to a structural representation

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NOTE This mechanism allows model ports and functional terminal definitionss to be associated regardless of their individual names.

The data associated with an Analytical_model_port_assignment are the following:

— assigned_analytical_model_port;

— assigned_functional_unit_terminal.

4.2.12.1 assigned_analytical_model_port

The assigned_analytical_model_port specifies the role of the Analytical_model_port (see 4.2.11) for the Analytical_model_port_assignment.

4.2.12.2 assigned_functional_unit_terminal

The assigned_functional_unit_terminal specifies the role of the Scalar_terminal_definition (see 4.2.639) for the Analytical_model_port_assignment.

NOTE Usually, only one Analytical_model is bound to a Functional_unit_definition at a time.

4.2.13 Analytical_model_scalar_port

An Analytical_model_scalar_port is a type of Analytical_model_port (see 4.2.11) that has a size of exactly one. The Analytical_model_scalar_port is used if there is a requirement to specify the cardinality of the ports associated by a relationship entity.

EXAMPLE 1 Some examples are in the allocation to a functional unit terminal definition for analysis, or in mapping between a distributed model and a lumped equivalent circuit model, or in mapping to a vector port specified in an external syntax.

4.2.14 Analytical_model_vector_port

An Analytical_model_vector_port is a type of Analytical_model_port (see 4.2.11) that has a size greater than one. The Analytical_model_vector_port is used in the converse case to the Analytical_model_-scalar_port. This part of ISO 10303 does not predefine the elements of a vector port.

NOTE The cardinality of the structured port is known and a list of names is specified for it. Examples are bus ports, multi-degrees-of-freedom connections, microwave domain modes, and address and data bus definitions.

The data associated with an Analytical_model_vector_port are the following:

— size.

4.2.14.1 size

The size specifies the integer greater than one for the cardinality of the Analytical_model_vector_port.

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Constraints:

WR1: The size shall be greater than one.

4.2.15 Analytical_model_vector_port_assignment

An Analytical_model_vector_port_assignment is a type of Managed_design_object (see 4.2.431). An Analytical_model_vector_port_assignment is the relationship between two or more Scalar_terminal_definition (see 4.2.639) and an Analytical_model_vector_port (see 4.2.14). Assignment of correspondence shall be by position in each list, when each list is sorted according to standard ASCII sorting order.

NOTE A usage of this capability is to map between a definition using this part of ISO 10303 and an architectural model defined in VHDL.

The data associated with an Analytical_model_vector_port_assignment are the following:

— assigned_analytical_model_vector_port;

— assigned_functional_unit_terminals.

4.2.15.1 assigned_analytical_model_vector_port

The assigned_analytical_model_vector_port specifies the role of the Analytical_model_vector_port (see 4.2.14) for the Analytical_model_vector_port_assignment.

4.2.15.2 assigned_functional_unit_terminals

The assigned_functional_unit_terminals specify the unique Scalar_terminal_definition (see 4.2.639) for the Analytical_model_vector_port_assignment. There shall be at least two but may be more than two Scalar_terminal_definition for an Analytical_model_vector_port_assignment.

NOTE 1 This facility is most useful when the two lists are of identical lengths.

NOTE 2 One list is not visible within this part of ISO 10303 due to the fact that this part of ISO 10303 does not specify the internal semantics of a vector_port in terms of Analytical_model_ports.

4.2.16 Analytical_representation

An Analytical_representation is a type of Managed_design_object (see 4.2.431). An Analytical_representation is the association of specific data to properties of an Analytical_model (see 4.2.10) in order to unambiguously characterize some behaviour of a real or imaginary object. The characterization may be considered to describe the behaviour exhibited by the model in a specific environment or for a range of environments for a specific experiment.

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NOTE 1 This entity accomplishes a function similar to the parameter assignment part of a statement in a Spice netlist, or a function or subroutine call in a computer program. This capability is useful where the parts in the library have many parameters, not all of which apply to each simulation model that could be used for the part. This entity matches up the correct parameter values with the correct model.

NOTE 2 The properties specified should be in accordance with the capabilities and limitations of the Analytical_-model. That is, the mathematical formulations in the Analytical_model apply over limited ranges of real product characteristics and environmental characteristics.

NOTE 3 This part of ISO 10303 does not standardize qualification of Analytical_representations for an intended usage.

The data associated with an Analytical_representation are the following:

— analytical_representation_name;

— model_parameter_assignment;

— model_representation.

4.2.16.1 analytical_representation_name

The analytical_representation_name specifies the string for the human-interpretable identifier for this Analytical_representation.

4.2.16.2 model_parameter_assignment

The model_parameter_assignment specifies the role of the Parameter_assignment (see 4.2.487) for the Analytical_representation. The model_parameter_assignment binds instance data to data slots in the Analytical_model. There shall be one or more Parameter_assignment for the Analytical_representation.

NOTE For each parameter declared in a model definition, an actual value must be assigned when that model is referenced, unless there is a default assignment included in the source code for the model.

4.2.16.3 model_representation

The model_representation specifies the Analytical_model (see 4.2.10) as the basis model for the Analytical_representation.

Constraints:

UR1: The analytical_representation_name shall be unique within a population of Analytical_representation.

WR1: Each member of model_parameter_assignment.assigned_parameter shall be a member of model_-representation.model_parameters.

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NOTE Only parameters declared in the model_representation are assigned values.

4.2.17 Angle_data_element

An Angle_data_element is a type of Data_element (see 4.2.173) where the requisite unit type is that of angular displacement. An Angle_data_element may be combined with a Qualified_data_element (see 4.2.606) in a complex instance to include uncertainty in an angle.

4.2.18 Angular_dimension_with_direction_vector

An Angular_dimension_with_direction_vector is a type of Dimensional_location (see 4.2.258) that defines the relationship between two Shape_element (see 4.2.645) in terms of the angle between them and a vector that provides an orientation to that angle. The angle is measured in the plane normal to the specified direction vector and in a clockwise direction as viewed in the direction specified by the vector. The measurement is from the Shape_element specified as the locating_shape_element to the Shape_element specified as the located_shape_element by the characterized Shape_element_locating_relationship (see 4.2.650).

The data associated with an Angular_dimension_with_direction_vector are the following:

— measurement_orientation.

4.2.18.1 measurement_orientation

The measurement_orientation specifies either the Datum_based_vector_orientation (see 4.2.182) or an Axis_placement (see 4.2.43). If the Datum_based_vector_orientation is specified as the measurement_orientation, the specified Datum_based_vector_orientation provides the orientation by which the angle is measured relative to Datum (see 4.2.176). If an Axis_placement is specified, the orientation is specified in the context of the representation of the Shape_elements the relationship of which is characterized by the Angular_dimension_with_direction_vector.

Constraints:

UR1: The combination of located_elements inherited from Dimensional_location and measurement_orientation shall be unique within a population of Angular_dimension_with_direction_vector.

WR1: The dimension_type of the Angular_dimension_with_direction_vector shall be "angular".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

WR2: The boolean value specified as directed shall be TRUE.

NOTE The attribute directed is declared in the Dimensional_location entity of which this entity is a subtype.

IP1: If the measurement_orientation specifies an Axis_placement, the Axis_placement shall be in the same context as the representations of the two Shape_elements that are located relative to each other by the Angular_dimension_with_direction_vector.

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4.2.19 Angular_size_dimension

An Angular_size_dimension is a type of Dimensional_size (see 4.2.259) that characterizes the angularity of a Shape_element (see 4.2.645). If the Angular_size_dimension is a Single_boundary_dimension (see 4.2.661), the Angular_size_dimension specifies the angle formed by the characterized Shape_element. If the Angular_size_dimension is a Dimensional_size_based_on_opposing_boundaries (see 4.2.260), the Angular_size_dimension specifies the angle formed by two Shape_elements that make up the characterized Shape_element.

The data associated with an Angular_size_dimension are the following:

— half_angle;

— major_angle.

4.2.19.1 half_angle

The half_angle specifies the boolean value that indicates whether the full angle is being characterized by the Angular_size_dimension, or whether the angle that is being characterized is the angle between the characterized Shape_element (see 4.2.645) and a centre line or centre plane of the characterized Shape_element. A value of TRUE indicates that the angle between the Shape_element and a centre line or centre plane is being characterized. A value of FALSE indicates that the full angle is being characterized.

4.2.19.2 major_angle

The major_angle specifies the boolean value that specifies the angle to which the Angular_size_dimension is applied. A value of TRUE indicates that it is the larger of the angles formed by the characterized Shape_element (see 4.2.645). A value of FALSE indicates that it is the smaller of the angles formed by the characterized Shape_element.

Constraints:

WR1: The dimension_type shall be "angular".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

4.2.20 Angularity_tolerance

An Angularity_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the requirement on the angularity of a Shape_element (see 4.2.645) in relation to one or two Datum (see 4.2.176).

NOTE Angularity_tolerance is defined in terms of tolerance zone definitions in 14.9 of ISO 1101.

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Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Centre_axis, Centre_-plane, Physical_feature_or_part_template, or Tangent_plane.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: There shall be at most two Datum in the Datum_system, the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system entity of which this entity is a subtype.

WR3: At least one Datum_plane or Datum_axis shall be in the Datum_system, the definition of which is specified as the datum_system_definition.

WR4: If the toleranced_shape_element is a Centre_plane, Physical_feature_or_part_template, or Tangent_plane, the Angularity_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_-or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_-definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_sel_size_characteristic as its specified_-boundary_size.

IP1: A Parallelism_tolerance as opposed to an Angularity_tolerance shall be applied if the requirement is on the angularity of a Shape_element in relation to a Datum axis or Datum plane and the theoretically exact value of the angle is 0 or is an integral multiple of 180 degrees (pi radians).

IP2: A Perpendicularity_tolerance as opposed to an Angularity_tolerance shall be applied if the requirement is on the angularity of a Shape_element in relation to a Datum_axis or Datum_plane and the theoretically exact value of the angle is an odd multiple of 90 degrees ($\pi/2$ radians).

IP3: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of an angularity tolerance is sensible.

4.2.21 Apex

An Apex is a type of Derived_shape_element (see 4.2.221) that is either a point that is derived by projecting a conical surface or the common point that is derived by projecting two or more conical surfaces. The Shape_element (see 4.2.645) from which the Apex is derived are associated with the Apex by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_relationships.

NOTE The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

Constraints:

IP1: The common intersection of three or more planes or two curves shall be treated as a Geometric_-intersection rather than as an Apex.

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IP2: The form of the Shape_elements from which the Apex is derived shall be consistent with conical surfaces from which an Apex can be derived.

4.2.22 Array_placement_group

An Array_placement_group is a type of Assembly_group_component (see 4.2.31) that is a group of Assembly_component (see 4.2.27) placed in an linear or rectangular regular pattern in the assembly. An Array_placement_group may be a Laminate_text_string_component (see 4.2.406). The position tolerance specification of an Assembly_component that is included in an array is different from an Assembly_component that is randomly placed. Text support in this part of ISO 10303 is limited to a linear pattern defined by the character to character spacing defined in the font definition. Spacing properties for items other than text is supported by appling Geometric Dimensioning and Tolerancing methods.

NOTE This part of ISO 10303 provides support for multi-line messages with one instance of the Laminate_-text_string_component for each line of the multi-line message.

EXAMPLE 1 Examples of components placed as arrays include: test points, thermal vias, integrated circuit memory devices, light emitting diodes, spare land areas, component terminal mating features where the component itself has terminals arranged in a grid, and text.

EXAMPLE 2 Figure 4 is an example layout for a component array. The Axis_placement (see 4.2.43) that is in the role of origin for the Package (see 4.2.466) definition in this example is placed at the centroid of the Package and consequently at the centroid of the Package_body (see 4.2.467). The illustration is typical of a drawing presentation of the design information conveyed by this part of ISO 10303. Each rectangle in the illustration is a representation of an instance of a Package_body.

4.2.23 Assembled_with_bonding

An Assembled_with_bonding is a type of Assembly_joint (see 4.2.32) that establishes the joint by bonding. Bonding requires use of material that may change state during the bonding process to form a permanent or semi-permanent joint. In this context, a permanent or semi-permanent joint means that repair of the affected part of the assembly would require destruction and replacement of the bond material.

NOTE The Assembled_with_bonding object relates two assembly features that are bonded and the Assembly_-bond_definition that specifies the category of the bond, its shape, its material, and its name.

EXAMPLE 1 Figure 5 illustrates the concept of the joint category described herein and the roles of the related application objects.

The data associated with an Assembled_with_bonding are the following:

— bond_assembly_position;

— default_bond_definition.

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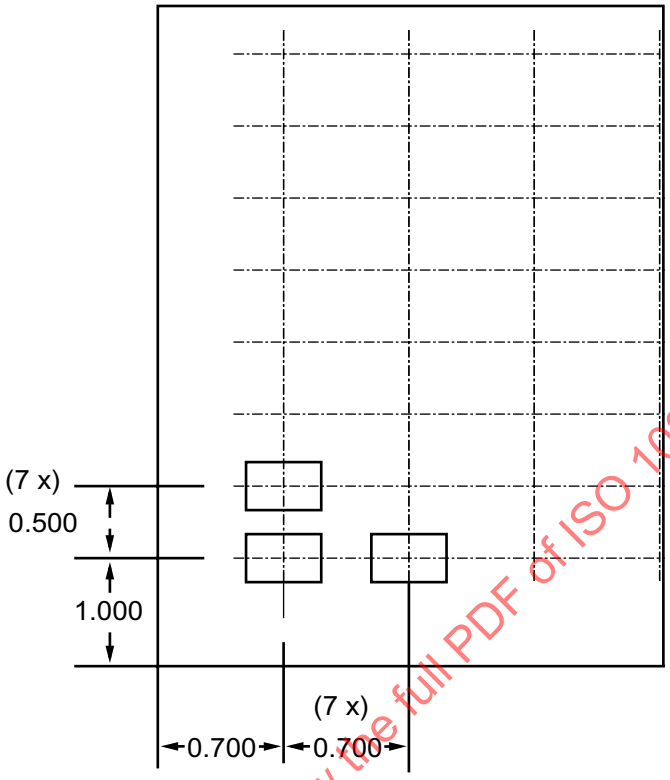

Figure 4 – Array_placement_group

4.2.23.1 bond_assembly_position

The bond_assembly_position is an inverse relationship that specifies that the Assembled_with_bonding shall be referenced by no more than one Bond_assembly_position as its bond. The bond_assembly_-position need not be specified for a particular Assembled_with_bonding. The position is provided to identify shape placement for analysis.

4.2.23.2 default_bond_definition

The default_bond_definition specifies the Assembly_bond_definition (see 4.2.26) used by the Assembled_with_bonding process to form a join.

EXAMPLE 1 A type of bond material is solder. A type of component feature is a component terminal.

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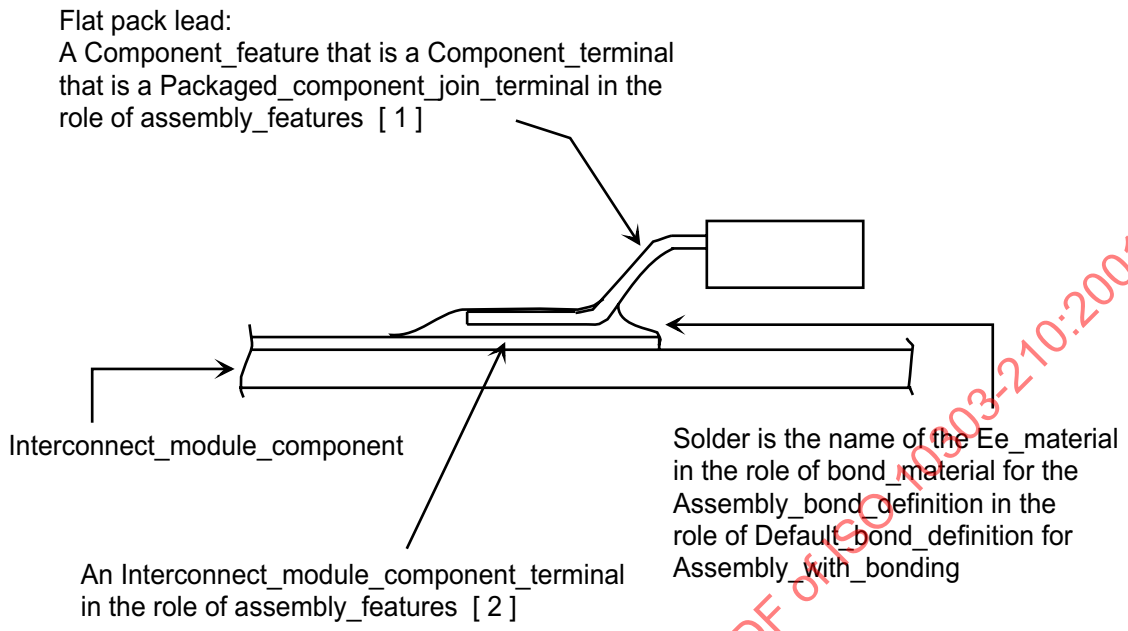

Figure 5 – Assembled_with_bonding

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Constraints:

WR1: The members of Part_feature utilized by Assembled_with_bonding that are inherited from Assembly_joint shall be the same members of Part_feature specified inclusively by Assembly_bond_definition bonded_feature_1 and bonded_feature_2.

4.2.24 Assembled_with_fasteners

An Assembled_with_fasteners is a type of Assembly_joint (see 4.2.32) that establishes the assembly by using fasteners to mechanically position a component so that its component mounting features are connected to component mounting features of another component in the assembly. The fasteners are associated with the base component using Product_association (see 4.2.590).

EXAMPLE 1 The usual case for this is the mounting hardware associated with a power device mounted to the Interconnect_module_component (see 4.2.373). Figure 6 illustrates the concept of the joint category described herein and the roles of the related Application Objects.

The data associated with an Assembled_with_fasteners are the following:

— sub_assembly.

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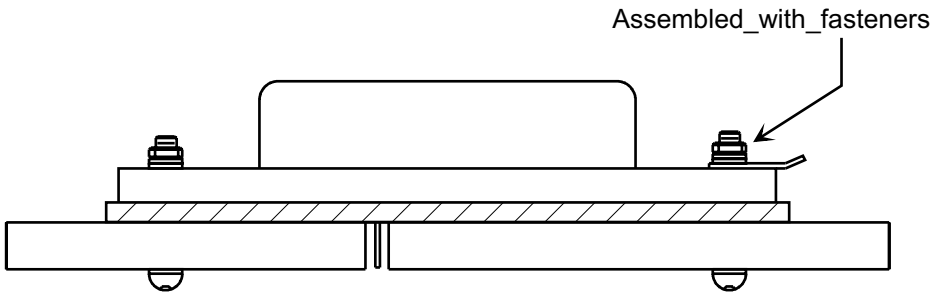

Figure 6 – Assembled_with_fasteners

4.2.24.1 sub_assembly

The sub_assembly specifies the Sub_assembly_relationship (see 4.2.707) that identifies the components required to be considered together in the assembly process for the Assembled_with_fasteners. The sub_-assembly does not describe a product structure hierarchy.

Constraints:

WR1: The Sub_assembly_relationship.related_components specified in the role of sub_assembly shall be in the same design view as the assembly_features inherited from Assembly_joint.

4.2.25 Assembly_alternate_product

An Assembly_alternate_product is a type of Alternate_select_product (see 4.2.9) where the alternate is valid only for a particular design. The alternate is valid for all instances of the defining_base_product inherited from Alternate_select_product within that design.

NOTE In specifying the components to be used in an assembly, it is a fairly common practice to stipulate that any usage of a given component (as referenced by a part number, for example) in that assembly may be replaced by some other specified component. Each of those other components is then an Assembly_alternate_product for the specified component (defining_base_product) for that assembly. The Assembly_alternate_product supports only this assembly-level alternate: i.e., it only refers to components that can serve as alternates for any usage of the specified component (the defining_base_product) in that assembly.

The data associated with an Assembly_alternate_product are the following:

— basis_context.

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4.2.25.1 basis_context

The basis_context specifies the role of the Physical_unit_design_view (see 4.2.535) for the Assembly_-alternate_product.

4.2.26 Assembly_bond_definition

An Assembly_bond_definition is a type of Managed_design_object (see 4.2.431). An Assembly_bond_-definition is the definition of the joint that uses bulk material to bond together portions of the assembly.

NOTE This part of ISO 10303 provides the ability to define the typical shape of the bond through the use of Default_assembly_bond_shape (see 4.2.206).

The data associated with an Assembly_bond_definition are the following:

— analytical_assembly_bond_representation;

— bond_category;

— bond_material;

— bonded_feature_1;

— bonded_feature_2;

— default_shape;

— name.

4.2.26.1 analytical_assembly_bond_representation

The analytical_assembly_bond_representation specifies the role of Analytical_representation for the Assembly_bond_definition. There may be one or more analytical_assembly_bond_representation for Asssembly_bond_defintion. The analytical_assembly_bond_representation need not be specified for a particular Assembly_bond_definition.

4.2.26.2 bond_category

The bond_category specifies the role of the External_definition (see 4.2.304) for the Assembly_bond_-definition.

NOTE This part of ISO 10303 does not predefine the classification of bonds for assembly.

EXAMPLE 1 Some typical types are wire bond, solder, and conductive adhesive.

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4.2.26.3 bond_material

The bond_material specifies the role of the Ee_material (see 4.2.273) for the Assembly_bond_definition. The bond material may be a composition.

4.2.26.4 bonded_feature_1

The bonded_feature_1 specifies one role of Part_feature for Assembly_bond_definition. The bonded_-feature_1 defines one of the Part_feature that will be utilized by Assembled_with_bonding.

4.2.26.5 bonded_feature_2

The bonded_feature_2 specifies one role of Part_feature for Assembly_bond_definition. The bonded_-feature_2 defines the second Part_feature that will be utilized by Assembled_with_bonding.

4.2.26.6 default_shape

The default_shape is an inverse relationship that specifies that there shall be no more than one Default_-assembly_bond_shape (see 4.2.206) that specifies the Assembly_bond_definition as its characterized_-bond_definition. The default_shape need not be specified for a particular Assembly_bond_definition.

4.2.26.7 name

The name specifies the string identifying the Assembly_bond_definition.

Constraints:

UR1: The name shall be unique within a population of Assembly_bond_definitions.

UR2: The item that is bonded_feature_1 shall not be bonded_feature_2.

4.2.27 Assembly_component

An Assembly_component is a type of Managed_design_object (see 4.2.431). An Assembly_component may be one of an Assembly_module_component (see 4.2.35), a Bare_die_component (see 4.2.48), an Interconnect_module_component (see 4.2.373), a Laminate_component (see 4.2.404), or a Packaged_-component (see 4.2.475), or additionally may be an Assembly_group_component (see 4.2.31), or additionally may be a Shield (see 4.2.655), or additionally may be a Thermal_component (see 4.2.723), or additionally may be a Routed_interconnect_component (see 4.2.619), or additionally may be an Interface_component (see 4.2.390). An Assembly_component is the occurrence of a Physical_unit (see 4.2.533) or Part_template (see 4.2.498) in an assembly. An Assembly_component may include additional product data over that defined in Physical_unit or Part_template. An Assembly_component that is no other type is intended to be an instance of a Physical_unit and not of a Part_template.

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EXAMPLE 1 Figure 7 illustrates a detail of an assembly drawing that shows the Assembly_component in relation to a cross-sectional view of the Interconnect_module_component. Figure 78 illustrates a complete assembly showing multiple Assembly_component.

NOTE 1 An Assembly_component may be assembled onto an Interconnect_module_component in the realization of an Assembly_module (see 4.2.34). An Assembly_component may be an occurrence of an Assembly_module_usage_view (see 4.2.38). An Assembly_component may be an occurrence of an Interconnect_module_usage_view (see 4.2.389). For the purposes of this model, the current interpretation is to treat an embedded component as a Packaged_component. The Interconnect_module_component_terminal (see 4.2.376) that mates with the Packaged_component_join_terminal (see 4.2.476) of the embedded component is not visible when the Assembly_module is assembled, but the Interconnect_module_component_terminal is still logically the interface to the Interconnect_module_component for the embedded component.

The manufacturing view supports the fact that the embedded component is installed during part of the sequential manufacturing process for the Interconnect_module (see 4.2.372).

NOTE 2 An Assembly_component may be a floor-planning symbol if the definition is an Assembly_module or an Interconnect_module. If the Assembly_component is used in this manner, then the actual components will be included in the design in a later iteration that results from including the detailed components from the Assembly_module or Interconnect_module using a computer processor. The processor may choose to support traceability by using the Component_make_from_relationship (see 4.2.98) to specify what component of the Assembly_module or Interconnect_module corresponds to the component in the design.

NOTE 3 Parameters may be assigned to Assembly_component by the Planned_characteristic object through the Assembly_requirements_allocation.

The data associated with an Assembly_component are the following:

— assembly;

— component_2d_shape;

— component_3d_shape;

— usage_definition.

4.2.27.1 assembly

The assembly is an inverse relationship that specifies that the existence of the Assembly_component is dependent on the existence of the Assembly_composition_relationship (see 4.2.30) that specifies the Assembly_component as its component. There shall be one or more Assembly_composition_relationship for an Assembly_component.

NOTE This cardinality supports multiple versions of the design, with the same member of Assembly_component.

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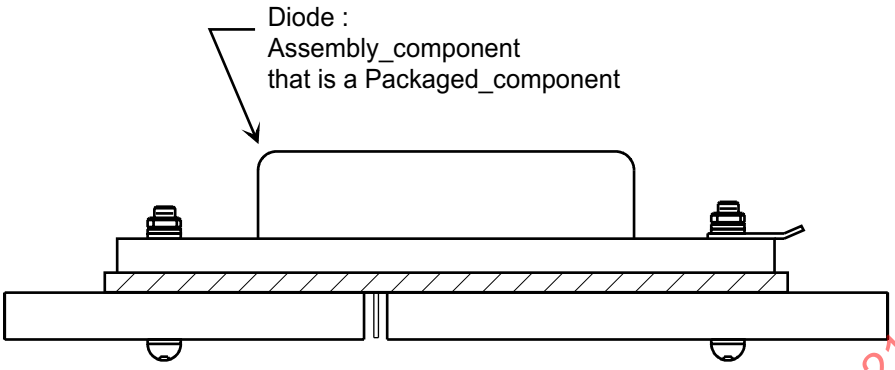

Figure 7 – Assembly_component

4.2.27.2 component_2d_shape

The component_2d_shape is an inverse relationship that specifies that there shall be no more than one Assembly_component_2d_shape (see 4.2.28) that specifies the Assembly_component as its shape_characterized_component. The component_2d_shape need not be supplied for a particular Assembly_component.

4.2.27.3 component_3d_shape

The component_3d_shape is an inverse relationship that specifies that there shall be no more than one Assembly_component_3d_shape (see 4.2.29) that specifies the Assembly_component as its shape_characterized_component. The component_3d_shape need not be supplied for a particular Assembly_component.

4.2.27.4 usage_definition

The usage_definition specifies either a Part_template (see 4.2.498) or a Physical_unit (see 4.2.533) for the Assembly_component. The usage_definition need not be supplied for an Assembly_component. The usage_definition is optional because some types of Assembly_component are defined through another mechanism. The types of Assembly_component for which usage_definition is required include the explicit statement of that requirement in their definition.

Constraints:

WR1: All members of assembly shall be for the same product.

WR2: No more than one member of assembly shall be for a version of the product.

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4.2.28 Assembly_component_2d_shape

An Assembly_component_2d_shape is a type of Managed_design_object (see 4.2.431). An Assembly_-component_2d_shape is the two-dimensional shape of an Assembly_component (see 4.2.27).

NOTE The shape used is defined by the Physical_unit_planar_shape (see 4.2.536), or by the equivalent for Part_template (see 4.2.498), referenced by the location transformation in Component_assembly_2d_position (see 4.2.85).

The data associated with an Assembly_component_2d_shape are the following:

— shape_characterized_component.

4.2.28.1 shape_characterized_component

The shape_characterized_component specifies the role of the Assembly_component (see 4.2.27) for the Assembly_component_2d_shape.

4.2.29 Assembly_component_3d_shape

An Assembly_component_3d_shape is a type of Managed_design_object (see 4.2.431). An Assembly_-component_3d_shape is the three-dimensional shape of an Assembly_component (see 4.2.27).

The data associated with an Assembly_component_3d_shape are the following:

— shape_characterized_component.

4.2.29.1 shape_characterized_component

The shape_characterized_component specifies the role of the Assembly_component (see 4.2.27) for the Assembly_component_3d_shape.

4.2.30 Assembly_composition_relationship

An Assembly_composition_relationship is a type of Managed_design_object (see 4.2.431). An Assembly_composition_relationship may be a Next_higher_assembly_relationship (see 4.2.454). An Assembly_composition_relationship relates an Assembly_component (see 4.2.27) to the assembly that it helps to compose.

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The data associated with an Assembly_composition_relationship are the following:

— assembly;

— assembly_bonding_agent;

— component;

— security_code.

4.2.30.1 assembly

The assembly specifies the Physical_unit_design_view (see 4.2.535) for the product realized by this Assembly_composition_relationship.

4.2.30.2 assembly_bonding_agent

The assembly_bonding_agent specifies the role of the Ee_material (see 4.2.273) for the Assembly_composition_relationship. There may be more than one Ee_material for the Assembly_composition_relationship. The assembly_bonding_agent need not be specified for a particular Assembly_composition_-relationship.

NOTE 1 The use of this attribute is appropriate where no feature shape data is available.

NOTE 2 To identify quantity of bulk material, this part of ISO 10303 predefines Assembly_material_composition_relationship (see 4.2.33).

4.2.30.3 component

The component specifies the role of the Assembly_component (see 4.2.27) for the Assembly_composition_relationship.

4.2.30.4 security_code

The security_code specifies the role of the Security_classification (see 4.2.642) for the Assembly_composition_relationship.

Constraints:

UR1: The combination of the assembly and the component shall be unique within a population of Assembly_composition_relationship.

WR1: At least one member of Assembly_composition_relationship shall specify a member of Assembly_component that is also a member of Interface_component.

NOTE This part of ISO 10303 requires the interface to the next level of assembly to exist. This is because this part of ISO 10303 supports design and archival of designs that may be used in higher levels of assembly.

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4.2.31 Assembly_group_component

An Assembly_group_component is a type of Assembly_component (see 4.2.27). An Assembly_group_-component may be either one or both of an Array_placement_group (see 4.2.22) or an Interfaced_-group_component (see 4.2.395). Each component that is part of a group is in the same design view as that group.

EXAMPLE 1 This application object is provided to support, for instance, the hardware items required for power device mounting.

NOTE 1 This application object is not included to support process plans.

NOTE 2 The intent is for all members of Assembly_component that are also in the role of related_components for Sub_assembly_relationship to be placed as a group in a placement activity using a CAD tool. However, each member of the group is placed individually in this standard. A receiving system should treat the relative placement of members of the group as derived data.

EXAMPLE 2 This application object supports paired-line layout by making each individual conductive_inter-connect_element associated by the sub_assembly_relationship entity to this application object one of the lines to be paired. Extensions to higher number of lines is obvious.

The data associated with an Assembly_group_component are the following:

— components.

4.2.31.1 components

The components is an inverse relationship that specifies that the existence of the Assembly_group_-component is dependent on the existence of the Sub_assembly_relationship (see 4.2.707) that specifies the Assembly_group_component as its relating_component. There shall be one or more Sub_assembly_-relationship for an Assembly_group_component.

NOTE The usual case is for one member of Sub_assembly_relationship to associate all relating components, but more than one is permitted. There is no semantic difference in this part of ISO 10303 between all the components being related with one member of Sub_assembly_relationship or each of the component being related having its own Sub_assembly_relationship.

4.2.32 Assembly_joint

An Assembly_joint is a type of Managed_design_object (see 4.2.431). An Assembly_joint may be either one of or both of an Assembled_with_bonding (see 4.2.23) or an Assembled_with_fasteners (see 4.2.24) or additionally may be a Connection_zone_based_assembly_joint (see 4.2.148). An Assembly_joint is the result of the process that establishes physical connectivity between component features of two components in an assembly.

EXAMPLE 1 Figure 8 illustrates the roles assigned to items in an assembly by a designer in constructing a member of Assembly_joint.

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NOTE 1 Assembly_joint is a central concept in this part of ISO 10303 that provides information necessary to extract a network description of a design from the assembly model. Once extracted, the description may be compared to the original requirements.

NOTE 2 Assembly_joint provides critical information necessary to evaluate the appropriateness of the two features related by Assembly_joint to their use in the assembly, given the process used for the joint.

NOTE 3 Assembly_joint provides critical information necessary to evaluate the appropriateness of the relative position of the two features related by Assembly_joint, given the process used for the joint, and the technology used for each of the associated components, including related tolerances.

NOTE 4 One of these components may be an Interconnect_module_component (see 4.2.373).

The data associated with an Assembly_joint are the following:

— assembly_features;

— description;

— name.

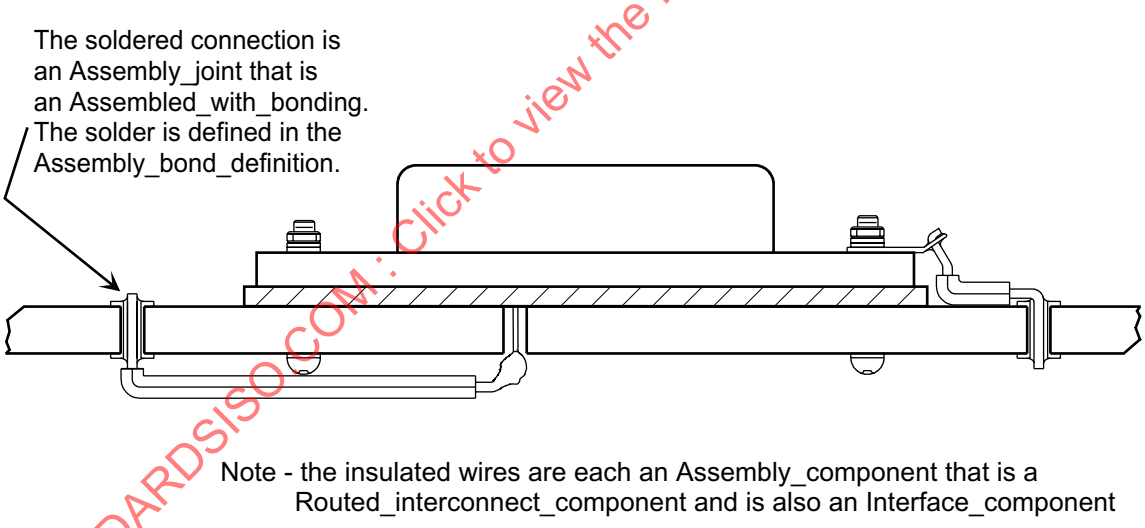

Figure 8 – Assembly_joint

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4.2.32.1 assembly_features

The assembly_features specify exactly two members of any of the following: Assembly_module_component_terminal (see 4.2.36), Bare_die_component_terminal (see 4.2.49), Interconnect_component_interface_terminal (see 4.2.370), Interconnect_component_join_terminal (see 4.2.371), Interconnect_module_component_terminal (see 4.2.376), Package_terminal_occurrence (see 4.2.474), Packaged_component_join_terminal (see 4.2.476), or Packaged_connector_component_interface_terminal (see 4.2.479), for the Assembly_joint.

4.2.32.2 description

The description specifies the text that in human-interpretable form describes the Assembly_joint. The description need not be specified for a particular Assembly_joint.

4.2.32.3 name

The name specifies the string of text for the Assembly_joint. The name need not be specified for a particular Assembly_joint.

Constraints:

WR1: Both members of assembly_feature shall be in the same design view.

WR2: A feature shall not be assembled to itself either directly or indirectly.

4.2.33 Assembly_material_composition_relationship

An Assembly_material_composition_relationship is a type of Managed_design_object (see 4.2.431). An Assembly_material_composition_relationship is the association between a Physical_unit_design_view (see 4.2.535) and Ee_material (see 4.2.273) for the purpose of bulk material callout.

NOTE This application object is intended solely to support raw material callout whose shape is not explicitly modeled in the product model.

EXAMPLE 1 Solder identified as a bonding agent may be aggregated for the assembly using this Application Object.

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The data associated with an Assembly_material_composition_relationship are the following:

— as_required;

— assembly;

— component_material;

— quantity;

— security_code.

4.2.33.1 as_required

The as_required specifies the LOGICAL type for the Assembly_material_composition_relationship. This type permits a user to specify that the amount of material to be supplied with the product may be determined at assembly on an item by item basis, where the item referred to is a real product delivered to a customer.

EXAMPLE 1 Adhesives, insulation and wire may all be cases where the value of the attribute is TRUE.

4.2.33.2 assembly

The assembly specifies the role of the Physical_unit_design_view (see 4.2.535) for the Assembly_material_composition_relationship.

4.2.33.3 component_material

The component_material specifies the role of the Ee_material (see 4.2.273) for the Assembly_material_composition_relationship.

4.2.33.4 quantity

The quantity specifies the role of the Data_element (see 4.2.173) for the Assembly_material_composition_relationship. The quantity need not be specified for the Assembly_material_composition_relationship.

4.2.33.5 security_code

The security_code specifies the role of the Security_classification (see 4.2.642) for the Assembly_material_composition_relationship.

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Constraints:

WR1: For an occurrence of a bulk material product, units shall be specified as one of the following: length_unit; amount_of_substance_unit; mass_unit; volume_unit; area_unit.

IP1: Wire used for jumpers that are explicitly defined shall be specified as a member of Interconnect_-component.

4.2.34 Assembly_module

An Assembly_module is a type of Physical_unit_design_view (see 4.2.535). An Assembly_module may be a Pca (see 4.2.510). An Assembly_module is an assembly design view of a product. This application object supports design reuse, modular product definitions, component libraries, and related technologies. There may be discipline views that further specialize this view.

EXAMPLE 1 Figure 78 is an illustration of an Assembly_module.

NOTE 1 An Assembly_module could be a ball grid array design, an MCM design, a disk drive design, a line card or plug-in module in a telecommunications rack, or a line replaceable unit in an airframe or spacecraft. Incomplete designs that have some specified functionality as defined by a functional definition may be included in a component library application, for example. The designs may be included in an active design by reference. At the appropriate time in the design phase, the single reference is replaced with individual references to the elements that compose the Assembly_module. Support is provided for maintaining the information necessary to trace back to the original Assembly_module from the released Assembly_component (see 4.2.27) through the Component_make_from_-relationship (see 4.2.98).

NOTE 2 Product categories other than Pca, such as MCM-L (Multichip Module, Laminated), MCM-D (Multichip Module, Deposited) and MCM-C (Multichip Module, Ceramic) may be included through the use of this application object, and population of the Technology (see 4.2.716) and Ee_product_category (see 4.2.275) application objects.

EXAMPLE 2 In this example (based on the previous notes), assembly technology is the process that bonds two products together (e.g., soldering, welding) by joining individual features of one product to individual features of the other product. The Assembly_module would have two components: A Packaged_part (see 4.2.481) and an Interconnect_module. The Interconnect_module would include a Land (see 4.2.407) pattern designed to optimize the assembly process yield for the Packaged_part and the Stratum (see 4.2.677) stackup of the Interconnect_module combination. Full knowledge of the Interconnect_module technology is available through the complete definition of the Passage_technology (see 4.2.509) and Stratum_technology (see 4.2.702) supported in this part of ISO 10303. The assembly technology characteristics assigned by an enterprise may be exchanged through population of the Ee_product_category and Ee_product_related_product_category (see 4.2.280) application objects. Technology classification may be exchanged using the Technology application object. If desired, Analytical_representation (see 4.2.16) may be populated to support process simulation. Package (see 4.2.466) may be used instead of Packaged_-part in the Assembly_module if there is no interest in electrical characteristics.

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Constraints:

WR1: If the attribute name specified by Ee_product_category that is in the role of product_classification specified by Ee_product (see 4.2.274) that is in the role of versioned_item specified by Ee_product_version (see 4.2.282) that is in the role of version specified by the supertype Ee_product_definition is "Assembly module", and if the sub category of the Ee_product_category is "Product and Interconnect Specific Assembly Technology", then the purpose for inclusion is to provide source data for a particular assembly technology. The attribute standard_product_indicator specified by the same member of Ee_product shall be true for industry standard pattern and material designation. The Interconnect_module_component (see 4.2.373) is included as part of this definition since this usage is to characterize the intersection of the Interconnect_module (see 4.2.372), the Assembly_component, and the assembly process.

The purpose of this usage of Assembly_module is to allow sufficient information to be exchanged to explicitly state the effects an assembly process has on the reference design embodied in the member of Assembly_module. Typical usage would include simulation models and explicit behavioural parameters to state the relevant effects in domain terms for decision support. This usage assumes that there is an equivalent usage of Interconnect_module in support of this usage.

WR2: A Laminate_component shall not be in the role of component for the Assembly_composition_relationship that references an Assembly_module in the role of assembly

WR3: For an occurrence of Assembly_module there will be either an associated Packaged_part or an associated Assembly_module_usage_view.

4.2.35 Assembly_module_component

An Assembly_module_component is a type of Assembly_component (see 4.2.27). This application object is an occurrence of the usage view of an Assembly_module (see 4.2.34), and could be either a design reuse item or an occurrence of the usage view of a real item.

NOTE Assembly_module_component represents an occurrence of a part concept for usage in one or more design views for the same product, where each design view is for a different version of the product. This is useful in a vertically integrated concurrent engineering environment, where full data sharing is allowed, as it permits visibility into the fact that there is a design definition of the component that is an Assembly_module.

EXAMPLE 1 It is useful to consider a daughter board instance as an Assembly_module_component rather than as an instance of Packaged_part (see 4.2.481) in this part of ISO 10303 for traceability to the design view for archival purposes for the design organization.

The data associated with an Assembly_module_component are the following:

— access_mechanisms;

— usage_definition.

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4.2.35.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Assembly_module_component is dependent on the existence of the Assembly_module_component_terminal (see 4.2.36) that specifies the Assembly_module_component as its associated_component. There shall be two or more Assembly_module_component_terminals for an Assembly_module_component.

4.2.35.2 usage_definition

The usage_definition specifies the role of the Assembly_module_usage_view (see 4.2.38) for the Assembly_module_component.

4.2.36 Assembly_module_component_terminal

An Assembly_module_component_terminal is a type of Component_terminal (see 4.2.105). The Assembly_module_component_terminal is included with the Assembly_module_component to assure the data integrity of references to the terminals of the Assembly_module_component.

The data associated with an Assembly_module_component_terminal are the following:

— associated_component;

— definition.

4.2.36.1 associated_component

The associated_component specifies the role of the Assembly_module_component (see 4.2.35) for the Assembly_module_component_terminal.

4.2.36.2 definition

The definition specifies the role of the Assembly_module_terminal (see 4.2.37) for the Assembly_module_component_terminal.

4.2.37 Assembly_module_terminal

An Assembly_module_terminal is a type of Part_terminal (see 4.2.502). An Assembly_module_terminal may be a Pca_terminal (see 4.2.511). An Assembly_module_terminal may be associated with an instance of Assembly_module_usage_view_connector_relationship (see 4.2.39) to specify connector level interface definition for an assembly. This association is maintained in the usage view.

NOTE The Assembly_module_terminal supports multi-level design, analysis, and verification in a multi-discipline environment. Explicit description of assembly_module_terminals allows connectivity requirements to be explicitly stated and interference requirements to be identified early in the design and development cycle.

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The data associated with an Assembly_module_terminal are the following:

— associated_definition;

— feature_shape;

— reference_terminal;

— related_connector;

— terminal_connection_zone.

4.2.37.1 associated_definition

The associated_definition specifies the role of the Assembly_module_usage_view (see 4.2.38) for the Assembly_module_terminal.

4.2.37.2 feature_shape

The feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Assembly_-module_terminal. There shall be one or more Feature_shape_occurrence for an Assembly_module_-terminal.

4.2.37.3 reference_terminal

The reference_terminal specifies a Packaged_part_interface_terminal (see 4.2.482) for the Assembly_-module_terminal. A reference_terminal need not be specified for a Package_part_interface_terminal.

4.2.37.4 related_connector

The related_connector specifies an Assembly_module_usage_view_connector_relationship (see 4.2.39) for the Assembly_module_terminal. A related_connector need not be specified for a Package_part_-interface_terminal.

4.2.37.5 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Assembly_module_terminal. There may be more than one Connection_zone for an Assembly_module_terminal.

NOTE The Feature_shape_occurrence (see 4.2.316) specified by the terminal or mounting feature may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is the Connection_zone.

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Constraints:

IP1: If a related_connector is specified, the position,shape, and orientation of the Assembly_module_-terminal shall be overriden by the reference_terminal position, shape, and orientation.

4.2.38 Assembly_module_usage_view

An Assembly_module_usage_view is a type of Physical_unit_usage_view (see 4.2.538). An Assembly_module_usage_view may be a Pca_usage_view (see 4.2.512). An Assembly_module_usage_view provides additional domain knowledge for the design organization.

NOTE 1 The Assembly_module_usage_view supports intellectual property protection. A design organization can control the amount of data they provide to a licensee or purchaser by including only a specifically tailored set of data in a usage view.

NOTE 2 Shape information is provided by Physical_unit_3d_shape (see 4.2.534) or by Physical_unit_planar_-shape (see 4.2.536).

EXAMPLE 1 This data can include the information currently included in an interface control drawing (ICD).

EXAMPLE 2 Figure 9 illustrates that the information in an Assembly_module_usage_view can be different from the information in a design view. The information in this illustration is sufficient to analyse airflow characteristics and interference characteristics, as well as information related to the connectors in the design.

The data associated with an Assembly_module_usage_view are the following:

— access_mechanisms;

— implemented_function;

— maximum_negative_component_height;

— maximum_positive_component_height.

4.2.38.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Assembly_-module_usage_view is dependent on the existence of the Assembly_module_terminal (see 4.2.37) that specifies the Assembly_module_usage_view as its associated_definition. There shall be two or more Assembly_module_terminals for an Assembly_module_usage_view.

4.2.38.2 implemented_function

The implemented_function specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Assembly_module_usage_view.

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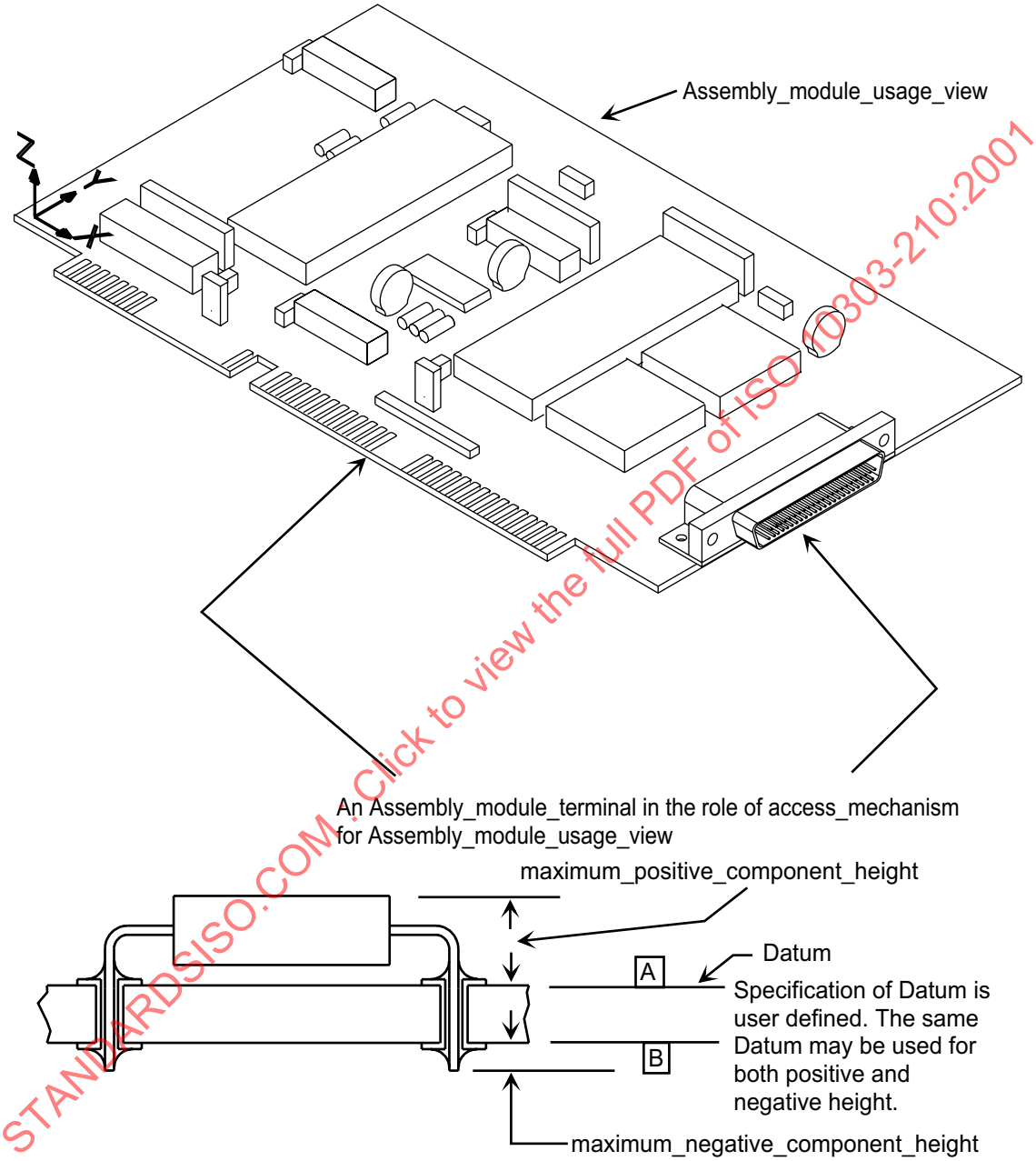

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Figure 9 – Assembly_module_usage_view

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4.2.38.3 maximum_negative_component_height

The maximum_negative_component_height specifies the largest Datum_based_length_measure (see 4.2.181) in the negative direction from the Datum (see 4.2.176) for the Assembly_module_usage_view. The maximum_negative_component_height need not be specified for a particular Assembly_module_usage_view.

EXAMPLE 1 An example of the maximum_negative_component_height attribute is for a printed circuit assembly with through-hole components, where the maximum lead protrusion dimension is given. That dimension is the maximum_negative_component_height. Figure 9 illustrates this example. Another example of the maximum_negative_component_height attribute is for a printed circuit assembly with surface mounted components on both sides. The maximum_negative_component_height attribute is for the distance between the established datum and the maximum material condition of the vertical dimension of the highest surface mount component on the secondary side of the printed circuit assembly.

4.2.38.4 maximum_positive_component_height

The maximum_positive_component_height specifies the largest Datum_based_length_measure (see 4.2.181) in the positive direction from the Datum (see 4.2.176) for the Assembly_module_usage_view. The maximum_positive_component_height need not be specified for a particular Assembly_module_usage_view.

EXAMPLE 1 An example of the maximum_positive_component_height attribute is for a printed circuit assembly where the maximum component height in the positive direction relative to a datum is given. This dimension pertains to the fit of the printed circuit assembly in its next assembly. That dimension is the maximum_positive_component_height. Figure 9 illustrates this example.

Constraints:

WR1: The direction from the Datum for the maximum_negative_component_height shall be negative in the Z axis direction.

WR2: The direction from the Datum for the maximum_positive_component_height shall be positive in the Z axis direction.

WR3: The function implemented shall be the function whose terminals are mapped to the terminals of this assembly module usage view.

IP1: The Datum orientation vector direction shall be considered to be positive when it is parallel to the normal of the top side of the interconnect substrate instance.

4.2.39 Assembly_module_usage_view_connector_relationship

An Assembly_module_usage_view_connector_relationship is a type of Usage_concept_usage_relationship (see 4.2.757) that associates the placement and orientation of a Packaged_connector (see 4.2.477) with an Assembly_module_usage_view (see 4.2.38). An Assembly_module_usage_view_connector_relationship supports the identification of connector placement data, when the design details are not available.

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The data associated with an Assembly_module_usage_view_connector_relationship are the following:

— externally_visible_partial_reference_designation.

4.2.39.1 externally_visible_partial_reference_designation

An externally_visible_partial_reference_designation specifies an Ee_name for an Assembly_module_-usage_view_connector_relationship (see 4.2.39). An externally_visible_partial_reference_designation supports the identification of a connector as a partial reference designation independent of the internal reference designation assigned by the designer of the product. This independence is required when the connector is actually designed as part of a complete lower level assembly.

Constraints:

UR1: The combination of externally_visible_partial_reference_designation and associating_usage inherited from Usage_concept_usage_relationship shall be unique in a population of Assembly_module_-usage_view_connector_relationship.

IP1: The associating_usage inherited from Usage_concept_usage_relationship shall be an Assembly_-module_usage_view.

IP2: The associated_usage inherited from Usage_concept_usage_relationship shall be a Packaged_connector.

4.2.40 Assembly_requirement_allocation

An Assembly_requirement_allocation is a type of Managed_design_object (see 4.2.431). An Assembly_requirement_allocation may be one or more of an Assembly_separation_requirement_allocation (see 4.2.41), an Electromagnetic_compatibility_requirement_allocation (see 4.2.297), or a Thermal_requirement_allocation (see 4.2.728). An Assembly_requirement_allocation is the relationship between the Ee_requirement_occurrence (see 4.2.283) and either an Assembly_component (see 4.2.27) or a Component_feature (see 4.2.90) that satisfies that Ee_requirement_occurrence.

The data associated with an Assembly_requirement_allocation are the following:

— assembly_assignment;

— requirement.

4.2.40.1 assembly_assignment

The assembly_assignment specifies either an Assembly_component (see 4.2.27) or a Component_feature (see 4.2.90) for the Assembly_requirement_allocation.

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4.2.40.2 requirement

The requirement specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Assembly_-requirement_allocation.

4.2.41 Assembly_separation_requirement_allocation

An Assembly_separation_requirement_allocation is a type of Assembly_requirement_allocation (see 4.2.40). An Assembly_separation_requirement_allocation provides for the physical spacing required among components of the assembly. The Assembly_separation_requirement_allocation is for the purpose of specifying separation between items based on the Ee_requirement_occurrence (see 4.2.283).

NOTE Multiple members of this entity may be populated in order to specify all the sets with which a given set will be disjoint, either thermally or electromagnetically.

The data associated with an Assembly_separation_requirement_allocation are the following:

— disjoint_assignment.

4.2.41.1 disjoint_assignment

The disjoint_assignment specifies either an Assembly_component (see 4.2.27) or a Component_feature (see 4.2.90) for the Assembly_separation_requirement_allocation. There shall be one or more Assembly_component or Component_feature for the Assembly_separation_requirement_allocation. The disjoint_assignment shall be applied pairwise.

Constraints:

IP1: The value of Length_data_element (see 4.2.422) shall be specified as a characteristic of the Ee_-requirement_occurrence (see 4.2.283) from Assembly_requirement_allocation.

4.2.42 Assembly_technology_specification

An Assembly_technology_specification is a type of Process_specification (see 4.2.589) that identifies and describes an activity to be performed on an Ee_product (see 4.2.274) or Ee_material (see 4.2.273) in order to produce an assembly.

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4.2.43 Axis_placement

An Axis_placement is a type of Managed_design_object (see 4.2.431). An Axis_placement may be an Axis_placement_2d (see 4.2.44) or an Axis_placement_3d (see 4.2.45). An Axis_placement is the transformation and orientation of one Cartesian_coordinate_system (see 4.2.66) relative to a referenced coordinate system. An Axis_placement is the rigid body transformation that transforms the geometry of the object being placed from its coordinate system to the Cartesian_coordinate_system in which the object is being placed. The dimensionality of Axis_placement is determined by the dimensionality of the object being placed.

The data associated with an Axis_placement are the following:

— device_orientation;

— translation.

4.2.43.1 device_orientation

The device_orientation specifies the Orientation (see 4.2.465) of an occurrence of a physical device in an Axis_placement.

4.2.43.2 translation

The translation specifies the Cartesian_point (see 4.2.67) that is the origin of a Cartesian_coordinate_-system (see 4.2.66) relative to the origin of a reference Cartesian_coordinate_system while maintaining the angular relationship among the axes of the two coordinate systems in the Axis_placement.

4.2.44 Axis_placement_2d

An Axis_placement_2d is a type of Axis_placement (see 4.2.43) that has two dimensions of translation.

4.2.45 Axis_placement_3d

An Axis_placement_3d is a type of Axis_placement (see 4.2.43) that has three dimensions of translation.

4.2.46 B_rep_2d

A B_rep_2d is a type of Bound_volume_shape (see 4.2.58) that is a bounded two-dimensional region defined by a face. A B_rep_2d shall have an outer boundary and may have any number of holes.

4.2.47 Bare_die

A Bare_die is a type of a Physical_unit_usage_view (see 4.2.538). A Bare_die is used to describe the physical shape of a semiconductor device.

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NOTE 1 In the PCA domain an occurrence of a Bare_die may be installed into an occurrence of a Package (see 4.2.466) to realize a Packaged_part (see 4.2.481), an occurrence of which is then mounted in the assembly. In this role of performing a function, a Bare_die has terminals.

NOTE 2 A Bare_die implements electrical functionality. It is not necessary to exchange Bare_die information for parts such as molded or ceramic resistors where there is not a separately identifiable and common industry understanding of a die.

NOTE 3 In the PCA domain an occurrence of a Bare_die may be mounted directly onto the occurrence of a usage view of a PCB.

The data associated with a Bare_die are the following:

— access_mechanisms;

— implemented_function;

— least_material_condition_centroid_location;

— maximum_height_above_die_seating_plane;

— maximum_material_condition_centroid_location;

— die_seating_plane;

— unit_technology.

EXAMPLE 1 A semiconductor die is a familiar example used in packaged components on PCAs.

4.2.47.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Bare_die is dependent on the existence of the Minimally_defined_bare_die_terminal (see 4.2.447) that specifies the Bare_die as its associated_definition. There shall be two or more Minimally_defined_bare_die_terminal for a Bare_die.

4.2.47.2 implemented_function

The implemented_function specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Bare_die.

4.2.47.3 least_material_condition_centroid_location

The least_material_condition_centroid_location specifies one role of the Cartesian_point (see 4.2.67) for the Bare_die. The least_material_condition_centroid_location is the center of mass for a bare die in the minimum material state. The least_material_condition_centroid_location need not be specified for a particular Bare_die.

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4.2.47.4 maximum_height_above_die_seating_plane

The maximum_height_above_die_seating_plane specifies the role of the Length_data_element (see 4.2.422) for the Bare_die. The maximum_height_above_die_seating_plane is the largest extent of the Bare_die above the die_seating_plane. The maximum_height_above_die_seating_plane need not be specified for a particular Bare_die.

4.2.47.5 maximum_material_condition_centroid_location

The maximum_material_condition_centroid_location specifies one role of the Cartesian_point (see 4.2.67) for the Bare_die. The maximum_material_condition_centroid_location is the center of mass for a bare die in the state that contains the most material. The maximum_material_condition_centroid_location need not be specified for a particular Bare_die.

4.2.47.6 die_seating_plane

The die_seating_plane specifies the Seating_plane (see 4.2.640) as a standard orientation reference for assembly purposes for the Bare_die. The seating_plane is simulating a mounting surface.

4.2.47.7 unit_technology

The unit_technology specifies the role of the Technology (see 4.2.716) for the Bare_die. This part of ISO 10303 does not predefined unit_technology classification.

EXAMPLE 1 Examples include a classification for process and material such as CMOS, BICMOS, ECL, etc.

NOTE 1 Additional categorization is supported with this part of ISO 10303 by using Ee_product_category (see 4.2.275) and related application objects.

NOTE 2 The Bare_die is a monolithic (silicon, germanium, gallium arsenide, etc.) component before encapsulation in a package. It has generally been passivated (e.g., with an oxide layer) to protect it from contamination.

Constraints:

WR1: The function implemented shall be the function whose terminals are mapped to the terminals of the bare die.

4.2.48 Bare_die_component

A Bare_die_component is a type of Assembly_component (see 4.2.27) that is defined by a Bare_die (see 4.2.47).

The data associated with a Bare_die_component are the following:

— usage_definition.

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4.2.48.1 usage_definition

The usage_definition specifies the role of the Bare_die for the Bare_die_component.

4.2.49 Bare_die_component_terminal

A Bare_die_component_terminal is a type of Component_terminal (see 4.2.105) that is an instance of a Bare_die_terminal (see 4.2.50). The Bare_die_component_terminal is the area on the bare die instance onto which an enterprise will place bond wires, joining the active areas on the die instance to the next level of assembly. It is not necessarily the shape of the land itself on the die.

The data associated with a Bare_die_component_terminal are the following:

— associated_component;

— definition.

4.2.49.1 associated_component

The associated_component specifies the Bare_die_component (see 4.2.48) to which the Bare_die_component_terminal provides electrical access.

4.2.49.2 definition

The definition specifies the role of the Bare_die_terminal for the Bare_die_component_terminal.

4.2.50 Bare_die_terminal

A Bare_die_terminal is a type of Minimally_defined_bare_die_terminal (see 4.2.447). A Bare_die_terminal is the surface area on a Bare_die (see 4.2.47) that corresponds to the functional terminal on that Bare_die.

EXAMPLE 1 A device_terminal_map in combination with a part_device_terminal are populated to map the functionality of a Bare_die to the functionality of the packaged_part for the occurrence of the Bare_die in the Packaged_part.

The data associated with a Bare_die_terminal are the following:

— external_connection_area;

— material.

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4.2.50.1 external_connection_area

The external_connection_area specifies the Connection_zone (see 4.2.147) of the Bare_die_terminal. The external_connection_area is the area on the surface of a Bare_die (see 4.2.47) to which an electrically conducting material shall be attached to access the electrical functionality of the Bare_die.

NOTE The Feature_shape_occurrence (see 4.2.316) inherited by the terminal may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is the Connection_zone.

4.2.50.2 material

The material specifies the role of the Ee_material (see 4.2.273) for the Bare_die_terminal.

Constraints:

WR1: The points comprising the external_connection_area shall reside in the shape of the Bare_die being accessed.

WR2: The points comprising the external_connection_area shall be defined in the coordinate system of the device being accessed via the external_connection_area.

4.2.51 Bevel_edge_feature_shape

A Bevel_edge_feature_shape is a type of Edge_shape (see 4.2.268) that describes a bevelled edge of a feature with a two-dimensional shape.

EXAMPLE 1 Figure 10 illustrates a detail of a fabrication drawing that presents some of the information provided by Bevel_edge_feature_shape. The figure illustrates the measurement conditions (including orientation) for generic width and angle attributes.

The data associated with a Bevel_edge_feature_shape are the following:

— maximum_bevel_angle;

— maximum_bevel_width;

— minimum_bevel_angle;

— minimum_bevel_width.

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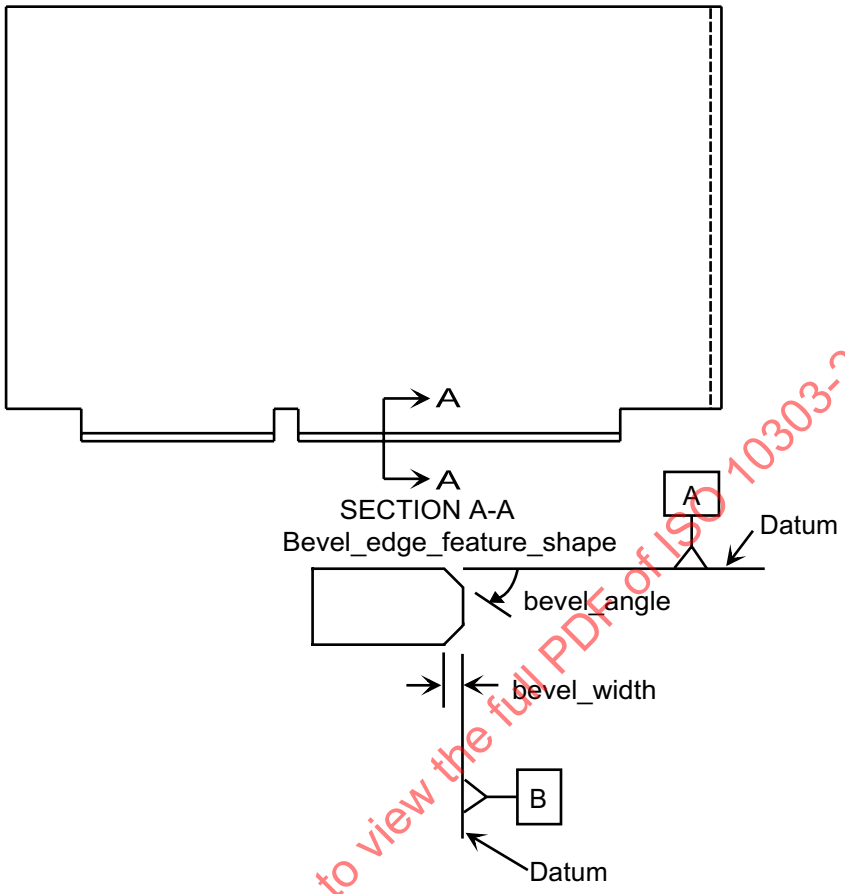

Figure 10 – Bevel_edge_feature_shape

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4.2.51.1 maximum_bevel_angle

The maximum_bevel_angle specifies the largest positive value of an Angle_data_element (see 4.2.17) measured in the plane of the Volume_shape_projection (see 4.2.772) relative to the edge surface being beveled (Datum B in figure 10). If the maximum_bevel_angle is zero, no material shall be removed. If the maximum_bevel_angle is between zero and 90 degrees material shall be removed from the surface closest to the Stratum (see 4.2.677) whose attribute primary_design_layer_stratum is TRUE. If the maximum_-bevel_angle is 90 degrees, no material shall be removed. If the maximum_bevel_angle is between 90 and 180 degrees, material shall be removed from the surface furthest from the Stratum whose attribute primary_design_layer_stratum is TRUE. Maximum_bevel_angles greater than 180 shall not result in material removal.

4.2.51.2 maximum_bevel_width

The maximum_bevel_width specifies the largest positive value of the Length_data_element (see 4.2.422) that is the width of the bevel relative to the edge surface that is beveled for the Bevel_edge_feature_shape.

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4.2.51.3 minimum_bevel_angle

The minimum_bevel_angle specifies the smallest positive value of an Angle_data_element (see 4.2.17) measured in the plane of the Volume_shape_projection (see 4.2.772) relative to the edge surface being beveled (Datum B in figure 10). If the minimum_bevel_angle is zero, no material shall be removed. If the minimum_bevel_angle is between zero and 90 degrees material shall be removed from the surface closest to the Stratum (see 4.2.677) whose attribute primary_design_layer_stratum is TRUE. If the bevel angle is 90 degrees, no material shall be removed. If minimum_bevel_angle is between 90 and 180 degrees, material shall be removed from the surface furthest from Stratum whose attribute primary_-design_layer_stratum is TRUE. Bevel_angles greater than 180 shall not result in material removal.

4.2.51.4 minimum_bevel_width

The minimum_bevel_width specifies the smallest positive value for the Length_data_element (see 4.2.422) that is the width of the bevel relative to the edge surface that is beveled for the Bevel_edge_feature_shape.

Constraints:

WR1: The Planar_projected_shape and Volume_shape_projection application objects shall be populated when this application object is populated, and shall be provided in the geometric model associated with this application object. Two members of Datum shall be populated when this application object is populated; one member shall be Datum A and the the other member shall be Datum B.

4.2.52 Blind_passage_template

A Blind_passage_template is a type of Unsupported_passage_template (see 4.2.756). The Blind_passage_template includes sufficient data to determine feature properties for passages that do not penetrate the complete substrate.

The data associated with a Blind_passage_template are the following:

— bottom_distance_from_datum_reference;

— datum_reference;

— of_measure_orientation.

4.2.52.1 bottom_distance_from_datum_reference

The bottom_distance_from_datum_reference specifies the role of the Shape_dimension_representation (see 4.2.644) for the Blind_passage_template.

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4.2.52.2 datum_reference

The datum_reference specifies the role of the Stratum_surface (see 4.2.699) for the Blind_passage_-template.

4.2.52.3 of_measure_orientation

The of_measure_orientation specifies normal or reversed as the measure orientation for the Blind_passage_template. Normal specifies that the orientation is parallel to the normal of the reference surface. Reversed specifies that the orientation is anti-parallel to the normal of the reference surface.

Constraints:

IP1: A datum_reference shall not be a Stratum_average_surface (see 4.2.679).

4.2.53 Blind_via

A Blind_via is a type of Via (see 4.2.761). Each Blind_via is either a Bonded_conductive_base_blind_via (see 4.2.56), a Non_conductive_base_blind_via (see 4.2.455), or a Plated_conductive_base_blind_via (see 4.2.548) . Blind_via is defined in IEC 60050-541.

EXAMPLE 1 Figure 11 illustrates an idealized cross-section of an interconnect substrate, showing the depth of penetration of a Blind_via into the substrate.

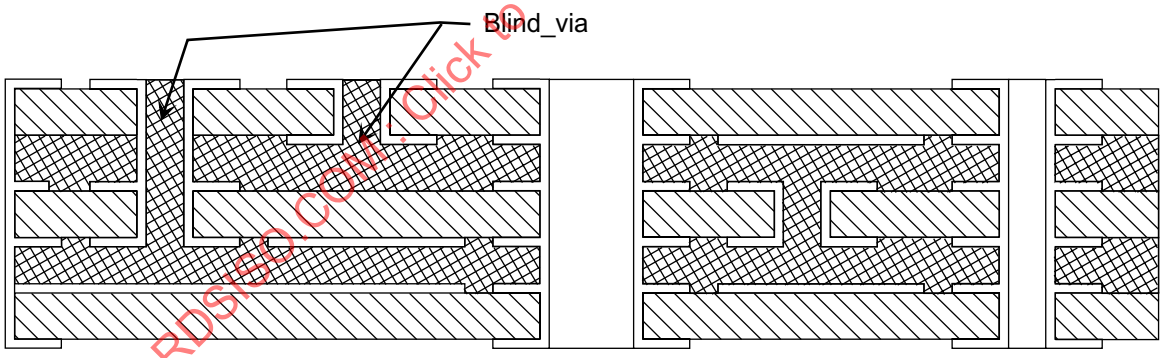

Figure 11 – Blind_via

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Constraints:

WR1: Only one end of a Blind_via shall be at a surface of the Interconnect_module.

4.2.54 Block

A Block is a type of Csg_primitive (see 4.2.163) which is used in forming a "CSG" solid model.

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4.2.55 Bond_assembly_position

A Bond_assembly_position is a type of Managed_design_object (see 4.2.431). A Bond_assembly_-position is the placement of an Assembled_with_bonding (see 4.2.23) within the Physical_unit_3d_shape (see 4.2.534) of an assembly. The Bond_assembly_position is an approximation to the actual position since it uses a default shape for the bond. There may be considerable variation between the default shape and actual shapes in teh "as delivered" product.

The data associated with a Bond_assembly_position are the following:

— assembly_model;

— bond;

— bond_definition_placement;

— bond_model.

4.2.55.1 assembly_model

The assembly_model specifies the Physical_unit_3d_shape (see 4.2.534) of the assembly for the Bond_-assembly_position.

4.2.55.2 bond

The bond specifies the role of the Assembled_with_bonding (see 4.2.23) for the Bond_assembly_posi-tion.

4.2.55.3 bond_definition_placement

The bond_definition_placement specifies the role of the Axis_placement_3d (see 4.2.45) for the Bond_-assembly_position. The placement specifies the transformation applied to the bond model to bring it into the assembly model.

4.2.55.4 bond_model

The bond_model specifies the Default_assembly_bond_shape (see 4.2.206) of the assembly bond for the Bond_assembly_position.

4.2.56 Bonded_conductive_base_blind_via

A Bonded_conductive_base_blind_via is a type of Blind_via (see 4.2.53) in which the material that composes the base of the Via (see 4.2.761) is conductive, and in which the base material has been implemented by conductively bonding the Land (see 4.2.407) at the base of the Via to a Stratum_feature (see 4.2.683) of an adjacent conducting Stratum (see 4.2.677).

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The data associated with a Bonded_conductive_base_blind_via are the following:

— features_join.

4.2.56.1 features_join

The features_join specifies the Stratum_feature_conductive_join (see 4.2.685) that joins the Land (see 4.2.407) on the interior facing surface of the Stratum (see 4.2.677) that is one end of the extent of the Blind_via (see 4.2.53) to the Land or other Stratum_feature (see 4.2.683) on the interior facing surface of the Stratum immediately adjacent to the first Stratum. The surfaces identified need be adjacent only through the extent of the intersection of these two joined features.

Constraints:

WR1: The Land at the base of the Bonded_conducted_base_blind_via shall be bonded to the Land on the adjacent Stratum.

NOTE A conductive bonding agent may be used to form the bond identified by features_join.

4.2.57 Boolean_csg_result

A Boolean_csg_result is a type of Managed_design_object (see 4.2.431). A Boolean_csg_result is a Bound_volume_shape (see 4.2.58), or a Csg_primitive (see 4.2.163), which is the result of using a boolean operator. The Boolean_csg_result allows for the composition or decomposition of a Bound_volume_shape, or a Csg_primitive.

The data associated with a Boolean_csg_result are the following:

— csg_operator;

— operand_1;

— operand_2.

4.2.57.1 csg_operator

The csg_operator specifies the difference, the intersection, or the union that determines the Boolean_csg_result.

4.2.57.2 operand_1

The operand_1 specifies the Bound_volume_shape (see 4.2.58), or a Csg_primitive (see 4.2.163) which is the first operand for the Boolean_csg_result.

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4.2.57.3 operand_2

The operand_2 specifies the Bound_volume_shape (see 4.2.58), or a Csg_primitive (see 4.2.163) which is the second operand for the Boolean_csg_result.

4.2.58 Bound_volume_shape

A Bound_volume_shape is a type of Feature_shape_definition (see 4.2.315). A Bound_volume_shape is one of an Advanced_b_rep (see 4.2.3), a Csg_solid (see 4.2.164), an Edge_based_wireframe (see 4.2.266), a Geometrically_bounded_surface (see 4.2.360), a Shell_based_wireframe (see 4.2.654), a Solid_of_linear_extrusion (see 4.2.666), or a B_rep_2d (see 4.2.46). A Bound_volume_shape is a three-dimensional geometric representation of a volume.

4.2.59 Boundary_based_position_tolerance

A Boundary_based_position_tolerance is a type of Position_tolerance_with_referenced_datum_system (see 4.2.559) and a type of Geometric_tolerance_with_applied_material_condition_property (see 4.2.356). The Boundary_based_position_tolerance defines a Tolerance_zone_boundary (see 4.2.734) that is offset from either the least material condition boundary or the maximum material condition boundary depending on the value of the applied_material_condition_property_name.

NOTE The attribute applied_material_condition_property_name is declared in the Geometric_tolerance_with_-applied_material_condition_property entity of which this entity is a subtype.

The least material condition boundary and the maximum material condition boundary are established either by one or more Dimensional_characteristic (see 4.2.256) or by a Profile_of_any_surface_tolerance (see 4.2.596). If the Boundary_based_position_tolerance specifies an applied_material_condition_property_name of "maximum_material_principle", the Tolerance_zone_boundary is offset from the maximum material condition boundary by half of the offset value and in the direction away from the least material condition boundary. If the Boundary_based_position_tolerance specifies an applied_material_-condition_property_name of "least_material_requirement", then the Tolerance_zone_boundary is offset from the least material condition boundary by half of the offset value and in the direction away from the maximum material condition boundary.

NOTE Boundary based position tolerances are discussed in 5.10.1 and 6.5.5.1 of ASME Y14.5M.

The data associated with a Boundary_based_position_tolerance are the following:

— profile_control.

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4.2.59.1 profile_control

The profile_control specifies a Profile_of_any_surface_tolerance_with_referenced_datum_system (see 4.2.597) that defines a Tolerance_zone_boundary (see 4.2.734) that establishes the least material condition boundary and the maximum material condition boundary from which the Positional_boundary (see 4.2.561) defined by the Boundary_based_position_tolerance is based. A profile_control need not be specified for a Boundary_based_position_tolerance.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Physical_feature_or_part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: If a Profile_of_any_surface_tolerance_with_referenced_datum_system is specified as the profile_control, both the Profile_of_any_surface_tolerance_with_referenced_datum_system and the Boundary_based_position_tolerance shall specify the same instance of Physical_feature_or_part_template as their toleranced_shape_element.

WR3: If a Profile_of_any_surface_tolerance_with_referenced_datum_system is specified as the profile_control, the Datum in the Datum_system of the Profile_of_any_surface_tolerance_with_referenced_datum_system shall be in the Datum_system of the Boundary_based_position_tolerance and shall be assigned the same datum precedence.

WR4: If the Boundary_based_position_tolerance specifies a Profile_of_any_surface_tolerance as the profile_control, the Boundary_based_position_tolerance shall specify a Profile_related_positional_boundary_definition as the tolerance_zone_or_boundary_definition; otherwise, the Boundary_based_position_tolerance shall specify a Positional_boundary_member_definition as the tolerance_zone_or_boundary_definition.

4.2.60 Boundary_size_characteristic

A Boundary_size_characteristic is a type of Managed_design_object (see 4.2.431). A Boundary_size_characteristic is either a Diametrical_boundary_size_characteristic (see 4.2.245) or an Opposing_boundary_set_size_characteristic (see 4.2.463). A Boundary_size_characteristic is a definition that characterizes the size of the Tolerance_zone_boundary (see 4.2.734).

The data associated with a Boundary_size_characteristic are the following:

— boundary_definition;

— maximum_tolerance_value;

— tolerance_value.

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4.2.60.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Boundary_-size_characteristic is dependent on the existence of the Boundary_zone_definition_with_specified_size (see 4.2.61) that specifies the Boundary_size_characteristic as its specified_boundary_size.

4.2.60.2 maximum_tolerance_value

The maximum_tolerance_value specifies the Length_data_element (see 4.2.422) that represents the maximum size of the Tolerance_zone_boundary (see 4.2.734). The maximum_tolerance_value need not be specified for the Boundary_size_characteristic.

NOTE Fig. 6-42 of ASME Y14.5M illustrates the application of a maximum value to a geometric tolerance.

4.2.60.3 tolerance_value

The tolerance_value specifies the Length_data_element (see 4.2.422) that represents the size of the Tolerance_zone_boundary (see 4.2.734) for the Boundary_size_characteristic.

4.2.61 Boundary_zone_definition_with_specified_size

A Boundary_zone_definition_with_specified_size is a type of Tolerance_zone_boundary_definition (see 4.2.735) in which the size of the Tolerance_zone_boundary (see 4.2.734) is defined by a Boundary_-size_characteristic (see 4.2.60). A Boundary_zone_definition_with_specified_size may be a Profile_-boundary_definition (see 4.2.591).

The data associated with a Boundary_zone_definition_with_specified_size are the following:

— specified_boundary_size.

4.2.61.1 specified_boundary_size

The specified_boundary_size specifies the Boundary_size_characteristic (see 4.2.60) that defines the size of the Tolerance_zone_boundary (see 4.2.734) for the Boundary_zone_definition_with_specified_size.

4.2.62 Bounding_curve

A Bounding_curve is a type of Curve . A Bounding_curve is provided in this part of ISO 10303 to describe the left side or the right side of a Conductive_interconnect_element_with_user_defined_single_-transition (see 4.2.138) on an interconnect substrate.

EXAMPLE 1 Figure 12 illustrates a detail of a layout drawing that shows a transition on a trace. Figure 13 illustrate several alternative functions (only one of which is used in this example). A selected function describes the mapping from a constant to the shape of the top side of the trace segment identified as "l" in subfigure "C" in figure 12. The segment "l" is supported in this part of ISO 10303 through a member of Conductive_interconnect_-element_with_user_defined_single_transition.

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The data associated with a Bounding_curve are the following:

— basis_curve;

— mapping_function.

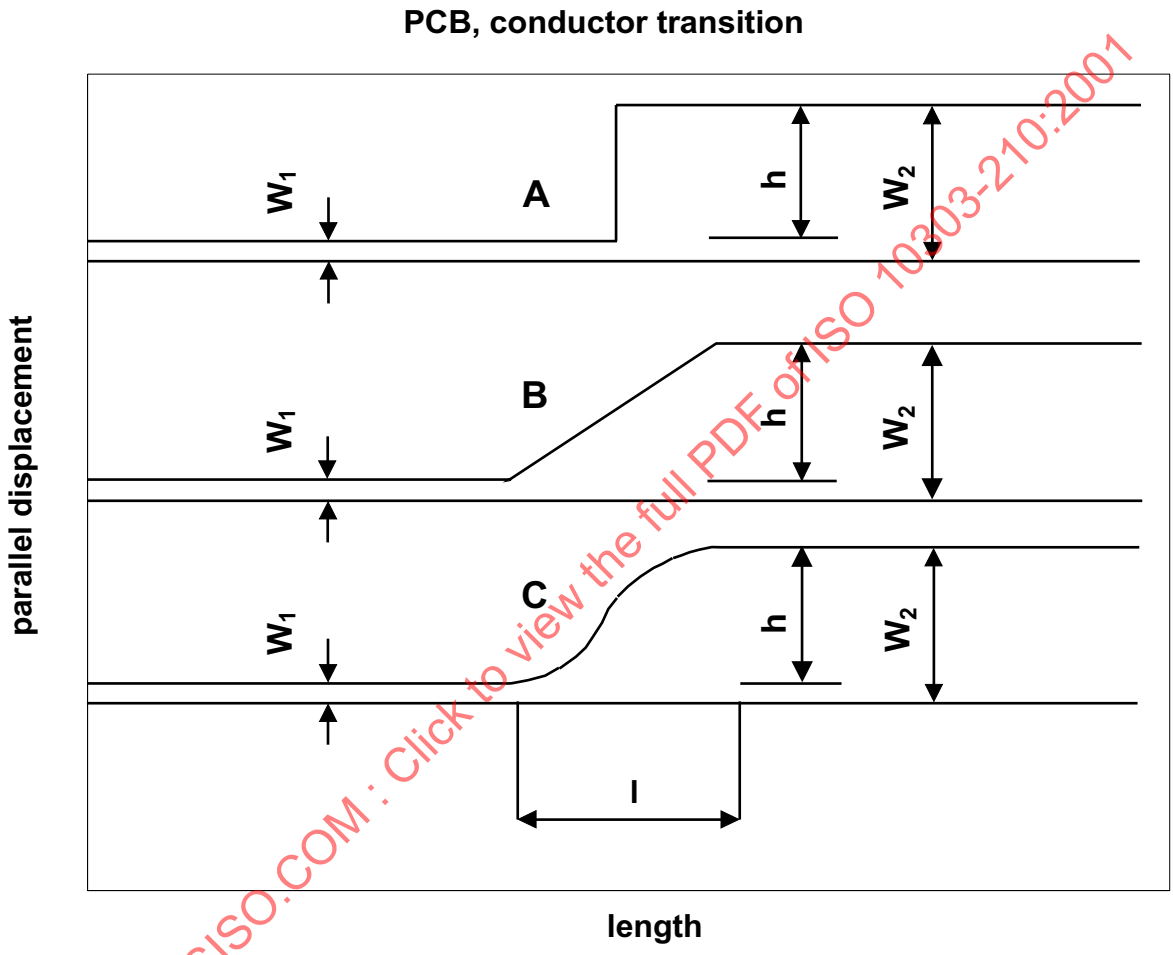

Figure 12 – Fabrication drawing detail

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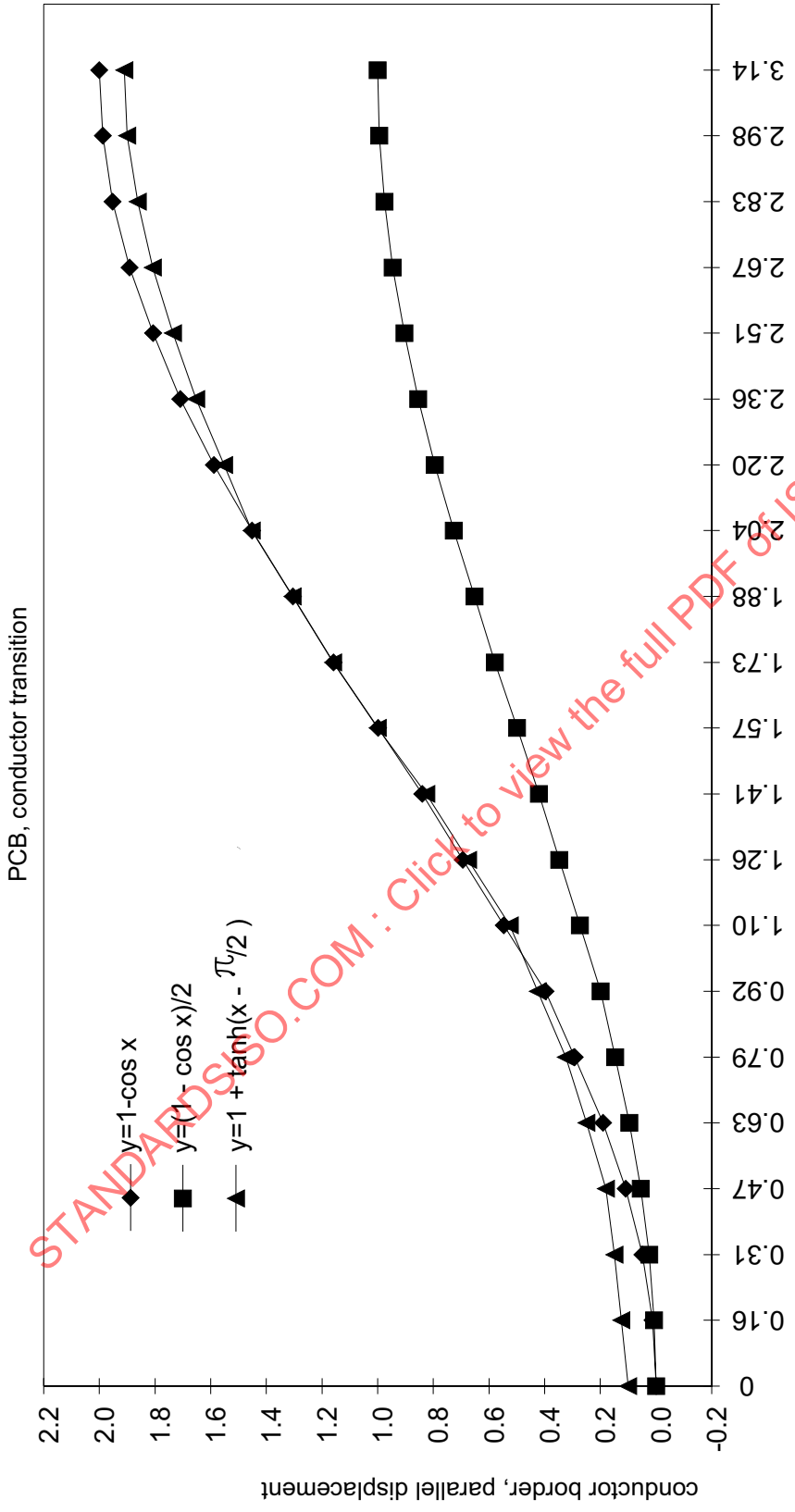

Figure 13 – Alternative functions for Bounding_Curve

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4.2.62.1 basis_curve

The basis_curve specifies the role of the Trimmed_line (see 4.2.752) for the Bounding_curve. The basis_curve founds the Bounding_curve in the geometric context of the design.

4.2.62.2 mapping_function

The mapping_function specifies the role of the External_definition (see 4.2.304) for the Bounding_curve. The mapping_function maps the Trimmed_line onto the resultant curve which is the Bounding_curve.

NOTE This mechanism ensures that the geometry may be exchanged using this part of ISO 103030 even though the mapping function is an externally defined concept.

Constraints:

WR1: A Bounding_curve shall not specify itself through the basis_curve, either directly or indirectly.

WR2: The mapping_function shall have the property of being a one to one map.

4.2.63 Buried_via

A Buried_via is a type of Via (see 4.2.761). Buried_via is defined in IEC 60050-541.

EXAMPLE 1 Figure 14 illustrates a Buried_via in a cross-section view of an interconnect substrate.

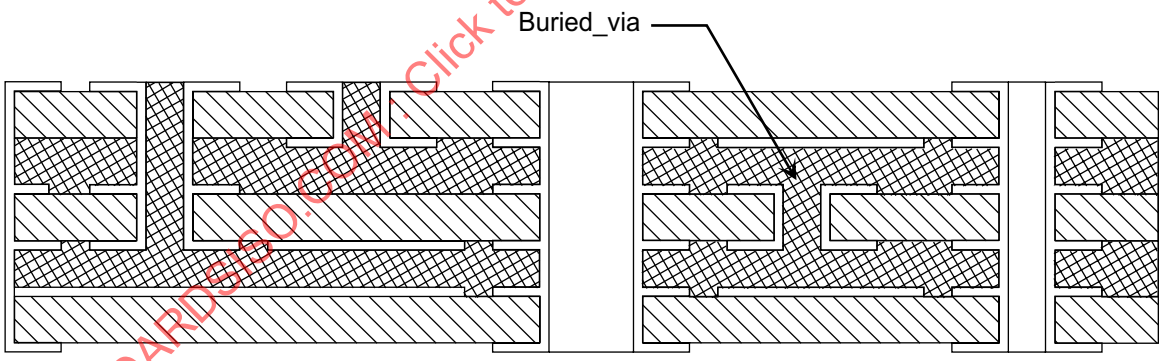

Figure 14 – Buried_via

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Constraints:

WR1: No end of the Buried_via shall be exposed in the Interconnect_module.

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4.2.64 Bus_element_relationship

A Bus_element_relationship is a type of Managed_design_object (see 4.2.431). A Bus_element_relationship is the association between the definition of a bus and its elements.

NOTE The Bus_element_relationship permits the exchange of bus definitions that when taken together from a root, may be represented by a directed acyclic graph.

The data associated with a Bus_element_relationship are the following:

— bus_definition;

— element.

4.2.64.1 bus_definition

The bus_definition specifies the role of the Bus_structural_definition (see 4.2.65) for the Bus_element_relationship.

NOTE The Bus_structural_definition is a composition. The current entity is helping to compose the Bus_structural_definition but it is not the only information that comprises a Bus_structural_definition.

4.2.64.2 element

The element specifies either a Bus_structural_definition (see 4.2.65) or a Functional_unit_network_node_definition (see 4.2.340) for the Bus_element_relationship. There shall be one or more Bus_structural_definition or Functional_unit_network_node_definition for a Bus_element_relationship. When there is more than one Bus_structural_definition or Functional_unit_network_node_definition, they shall be ordered. A Bus_structural_definition or Functional_unit_network_node_definition shall not appear more than once in the collection.

Constraints:

UR1: The combination of the bus_definition and the element shall be unique within a population of Bus_element_relationships.

4.2.65 Bus_structural_definition

A Bus_structural_definition is a type of Managed_design_object (see 4.2.431). A Bus_structural_definition is the aggregate or composition of the mathematical or logical structure of the bus. If a bus were to be represented by a graph, the Bus_structural_definition would be a root node for the bus in that representation.

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NOTE 1 A bus is a composition concept. Once defined, the bus definition can be used in various connectivity related aspects of the design. Several of the possible usages are conflicting and rules are provided to ensure unambiguous data. The structure of the reference model prohibits certain conflicting usages from occurring simultaneously.

NOTE 2 Ordered definition of buses is supported in this part of ISO 10303 by interpreting the name of the bus element as indicating the position in the sequence, using normal ASCII ordering for regular expressions. Spaces are not allowed in names.

The data associated with a Bus_structural_definition are the following:

— bus_name;

— composition;

— external_bus_access.

4.2.65.1 bus_name

The bus_name specifies the string identifying the Bus_structural_definition.

NOTE A project may establish project wide default names for buses. The identifier should then be globally unique within that project.

4.2.65.2 composition

The composition is an inverse relationship that specifies that the existence of the Bus_structural_definition is dependent on the existence of the Bus_element_relationship (see 4.2.64) that specifies the Bus_structural_definition as its bus_definition.

4.2.65.3 external_bus_access

The external_bus_access is an inverse relationship that specifies that there shall be no more than one Functional_unit_network_terminal_definition_bus_assignment (see 4.2.341) that specifies the Bus_structural_definition as its connected_bus. The external_bus_access need not be supplied for a particular Bus_structural_definition.

Constraints:

UR1: The bus_name shall be unique within a population of Bus_structural_definitions.

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4.2.66 Cartesian_coordinate_system

A Cartesian_coordinate_system is a type of Managed_design_object (see 4.2.431). A Cartesian_coordinate_system is a system of two coordinates that locates a point on a plane and measures its distance from either of two intersecting straight-line axes along a line parallel to the other axis, or a system of three coordinates that locates a point in space and measures its distance from any of three intersecting coordinate planes measured parallel to that one of three straight- line axes that is the intersection of the other two planes.

The data associated with a Cartesian_coordinate_system are the following:

— angle_unit_of_measure;

— angular_uncertainty;

— dimensionality;

— length_unit_of_measure;

— length_uncertainty.

4.2.66.1 angle_unit_of_measure

The angle_unit_of_measure specifies either degree or radian as the measurement unit of the Cartesian_coordinate_system.

4.2.66.2 angular_uncertainty

The angular_uncertainty specifies the Angle_data_element (see 4.2.17) of the uncertainty of angularity for the Cartesian_coordinate_system.

NOTE This value is based on the precision of the processor that created the model.

4.2.66.3 dimensionality

The dimensionality specifies either the two-dimensional or three-dimensional nature of the Cartesian_coordinate_system.

4.2.66.4 length_unit_of_measure

The length_unit_of_measure specifies the string for the unit of measurement for the Cartesian_coordinate_system. This shall be interpreted as a length unit of measure.

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4.2.66.5 length_uncertainty

The length_uncertainty specifies the Length_data_element (see 4.2.422) of the uncertainty of length for the Cartesian_coordinate_system.

NOTE This value is based on the precision of the processor that created the model.

4.2.67 Cartesian_point

A Cartesian_point is a type of Managed_design_object (see 4.2.431). A Cartesian_point is a geometric point in cartesian space. The requirements of the domain are for two-dimensional and three-dimensional geometry. Each usage of geometry in the domain will specify the required dimensionality.

4.2.68 Cartesian_transformation_operator_2d

A Cartesian_transformation_operator_2d is a type of Managed_design_object (see 4.2.431). A Cartesian_transformation_operator_2d defines a geometric transformation in two-dimensional space composed of translation, rotation, mirroring and uniform scaling. A precise mathematical definition for Cartesian_transformation_operator_2d is provided in ISO 10303-42.

The data associated with a Cartesian_transformation_operator_2d are the following:

— device_orientation;

— scale;

— translation.

4.2.68.1 device_orientation

The device_orientation specifies the role of the Orientation (see 4.2.465) for the Cartesian_transformation_operator_2d.

4.2.68.2 scale

The scale specifies the role of the Positive_ratio_measure (see 4.2.567) for the Cartesian_transformation_operator_2d.

4.2.68.3 translation

The translation specifies the role of the Cartesian_point (see 4.2.67) for the Cartesian_transformation_-operator_2d.

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Constraints:

IP1: Mirroring shall be only about the local Y axis, which "local Y axis" is defined as a): being parallel to the Y axis of the current coordinate system and b): intersecting the Cartesian_point which is in the role of translation for this Cartesian_transformation_operator_2d.

EXAMPLE 1 A point at (X = 3, Y = 2) would be at (X = -3, Y = 2) after being transformed using the Cartesian_transformation_operator_2d if no rotation were applied and no translation were applied, but mirroring were applied.

NOTE Typically the transformation matrix is the result of applying the ordered sequence of "rotate, mirror, translate" operations to an identity matrix. Placing translate last in the sequence satisfies the requirement that mirroring shall be about a local axis.

IP2: The determinant of the transformation matrix shall have a value of -1.0 or +1.0.

NOTE In a received file the value of the determinant may not be exactly 1.0 or -1.0 due to roundoff error. Since these are the only two allowed values, standard techniques to deal with the error are easily applied.

IP3: The scale value for the transformation shall be one.

IP4: Both axis1 and axis2 of the cartesian_transformation_operator_2d entity defined in ISO 10303-42 shall exist in an implementation of this requirement.

4.2.69 Centre_axis

A Centre_axis is a type of Centre_of_symmetry (see 4.2.70) that is axial in form. The Shape_element (see 4.2.645) from which the Centre_axis is derived are associated with the Centre_axis by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_relationships.

NOTE 1 The attribute deriving_relationships is declared in the Derived_shape_element (see 4.2.221) entity of which this entity is a subtype.

NOTE 2 The precise interpretation of a Centre_axis is context dependent. That is, the distinction is not made between an axis of a feature and a derived median line of a feature as defined in 1.3 of ASME Y14.5M.

EXAMPLE 1 A Position_tolerance (see 4.2.558) and a Straightness_tolerance (see 4.2.676) may be applied to the same Centre_axis of a cylindrical Shape_element.

Constraints:

IP1: The form of the Shape_elements from which the Centre_axis is derived shall be consistent with the form of shape elements from which a centre axis can be derived.

4.2.70 Centre_of_symmetry

A Centre_of_symmetry is a type of Derived_shape_element (see 4.2.221) that is derived by determining the geometric centre of one or more Shape_element (see 4.2.645). A Centre_of_symmetry is one of a Centre_axis (see 4.2.69), a Centre_plane (see 4.2.71), or a Centre_point (see 4.2.72).

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4.2.71 Centre_plane

A Centre_plane is a type of Centre_of_symmetry (see 4.2.70) that is planar in form. The Shape_element (see 4.2.645) derived from the Centre_plane is associated with the Centre_plane by the Shape_element_-deriving_relationship (see 4.2.649) that are specified as the deriving_relationships.

NOTE 1 The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

NOTE 2 The precise interpretation of a Centre_plane is context dependent. That is, the distinction is not made between the centre plane of a feature and a derived median plane of a feature as defined in 1.3 of ASME Y14.5M.

EXAMPLE 1 A Position_tolerance and a Straightness_tolerance may be applied to a Centre_plane that is derived from a Composite_unit_shape_element that consists of two opposing surfaces of a notch (or tab).

Constraints:

IP1: The form of the Shape_elements from which the Centre_plane is derived shall be consistent with the form of shape elements from which a centre plane can be derived.

4.2.72 Centre_point

A Centre_point is a type of Centre_of_symmetry (see 4.2.70) the form of which is that of a point. The Shape_element (see 4.2.645) from which the Centre_point is derived are associated with the Centre_-point by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_rela-tionships.

NOTE The attribute deriving_relationships is declared in the Derived_shape_element (see 4.2.221) entity of which this entity is a subtype.

Constraints:

IP1: The form of the Shape_elements from which the Centre_point is derived shall be consistent with the form of shape elements from which a centre point can be derived.

4.2.73 Certification

A Certification is a type of Managed_design_object (see 4.2.431). A Certification is a granting of ap-proval for use of a Supplied_product_version (see 4.2.709).

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The data associated with a Certification are the following:

— certification_approval;

— certification_date;

— certification_number;

— certified_product_version.

4.2.73.1 certification_approval

The certification_approval specifies the Ee_approval (see 4.2.269) of the Certification.

4.2.73.2 certification_date

The certification_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) for the Certification.

4.2.73.3 certification_number

The certification_number specifies the Ee_text (see 4.2.293) that identifies the Certification.

4.2.73.4 certified_product_version

The certified_product_version specifies the Supplied_product_version (see 4.2.709) for the subject of the Certification.

Constraints:

UR1: The certification_number shall be unique within a population of Certifications.

4.2.74 Change_design_object_management_relationship

A Change_design_object_management_relationship is a type of Design_object_management_relationship (see 4.2.238) that provides information about design changes, including the swapping changes among components, gates, or terminals. A Change_design_object_management_relationship may be a Component_swap_specification (see 4.2.104), a Gate_path_swap_specification (see 4.2.351), or a Terminal_swap_specification (see 4.2.718).

The data associated with a Change_design_object_management_relationship are the following:

— current_design_object;

— previous_design_object.

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4.2.74.1 current_design_object

The current_design_object specifies the Managed_design_object (see 4.2.431), after the design change, for the Change_design_object_management_relationship. The current_design_object is in the scope of the current_design.

4.2.74.2 previous_design_object

The previous_design_object specifies the Managed_design_object (see 4.2.431), before the design change, for the Change_design_object_management_relationship. The previous_design_object is in the scope of the previous_design.

Constraints:

UR1: The combination of the current_design_object and the current_design inherited from Design_object_management_relationship shall be unique within a population of Change_design_object_management_relationships.

UR2: The combination of the previous_design_object and the previous_design inherited from Design_object_management_relationship shall be unique within a population of Change_design_object_management_relationships.

WR1: The current_design_object and the previous_design_object shall be of the same type of application object, as defined in this part of ISO 10303.

NOTE A design change may affect only the attributes of the object and not its identifier.

4.2.75 Change_order

A Change_order is a type of Work_order (see 4.2.774) that authorizes the development of a modified design of an Ee_product (see 4.2.274), resulting in a new Ee_product_version (see 4.2.282).

The data associated with a Change_order are the following:

— adopted_solution.

4.2.75.1 adopted_solution

The adopted_solution specifies the Design_object_management_relationship (see 4.2.238), or Ee_text (see 4.2.293) which is to be implemented by the Change_order.

4.2.76 Change_request

A Change_request is a type of Work_request (see 4.2.775) that identifies the proposed extent of work to be done to modify the design of a product.

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The data associated with a Change_request are the following:

— consequence;

— recommended_solution;

— version.

4.2.76.1 consequence

The consequence specifies the Ee_text (see 4.2.293) that describes the impact that the Change_request will have on the product. There shall be one or more Ee_text for a Change_request.

4.2.76.2 recommended_solution

The recommended_solution specifies one or more Design_object_management_relationship (see 4.2.238), or Ee_text (see 4.2.293) of a potential solution which meets the requirements defined in the Change_request. A recommended_solution need not be specified for a Change_request.

4.2.76.3 version

The version specifies the string identifying a Change_request. The version shall be human interpretable.

Constraints:

UR1: The combination of the version and the work_request_id inherited from Work_request shall be unique within a population of Change_request.

4.2.77 Characteristic

A Characteristic is a type of Managed_design_object (see 4.2.431). A Characteristic may be a Numeric_parameter (see 4.2.460). A Characteristic is a property of an item.

NOTE A Characteristic may describe either a physical item, like a realized part, or a description that is unrealizable, such as a simulation model.

The data associated with a Characteristic are the following:

— property_value;

— reference_document;

— type_name.

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4.2.77.1 property_value

The property_value specifies either a Data_element (see 4.2.173), an External_definition (see 4.2.304), or one of a boolean type, a LOGICAL, or a string type, for the Characteristic.

4.2.77.2 reference_document

The reference_document specifies the Ee_document (see 4.2.271) or a string identifying this Characteristic.

NOTE This part of ISO 10303 explicitly supports the unambiguous exchange of properties whose names are registered by a registration authority and whose definitions are included in data dictionaries. This part of ISO 10303 includes facilities to unambiguously exchange a wide variety of units including SI, user named, and derived.

4.2.77.3 type_name

The type_name specifies the string for this Characteristic.

Constraints:

IP1: The string representing the type_name shall not appear more than once in the reference_document in the role of "type name for Characteristic".

4.2.78 Circular_runout_tolerance

A Circular_runout_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on the run-out of circular elements of a Physical_feature_or_part_template (see 4.2.527) in relation to a Datum_axis (see 4.2.177). Where run-out is the quality or state of having perfect form and axial alignment in relation to an axis. The Physical_feature_or_part_template may be coaxial or normal to the Datum_axis. If the Circular_runout_tolerance is applied at a specified angle the defined Tolerance_zone_definition (see 4.2.739) is a Runout_tolerance_zone_definition_with_specified_angle (see 4.2.636).

NOTE 1 A circular run-out tolerance is typically verified by placing a full movement indicator against the surface of the part at the desired orientation and location and then rotating the part one complete revolution about the datum axis. The value of the full indicator movement is then read. This process is repeated at each of the desired test locations. If any one of the full indicator movement readings is greater than the specified tolerance value the surface has exceeded one of the tolerance zones and the part fails the inspection. In theory, there are an infinite number of test locations. However, in practice, a finite number of test locations are measured.

NOTE 2 Circular run-out tolerance is defined in terms of tolerance zone definitions in 14.13 of ISO 1101.

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Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Physical_feature_or_-part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Circular_runout_tolerance shall not be a Geometric_tolerance_with_applied_material_condition_property.

WR3: There shall be at most two Datum in the Datum_system the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system entity of which this entity is a subtype.

WR4: There shall be a Datum_axis in the Datum_system the definition of which is specified as the datum_system_definition.

WR5: The Datum_system_defining_conditions that is specified as the datum_system_definition shall be a Datum_system_defining_conditions_without_material_conditions.

WR6: The Circular_runout_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_-or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_-definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_-boundary_size.

IP1: The form of the toleranced Physical_feature_or_part_template shall be consistent with the form of a physical feature for which the application of a circular run-out tolerance is sensible.

4.2.79 Circularity_tolerance

A Circularity_tolerance is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) that specifies or partially specifies the design requirement on the circularity, or roundness, of either a Shape_element (see 4.2.645)(if the Shape_element specified as the toleranced_shape_element is circular, essentially two-dimensional); or of the cross-sectional elements of the toleranced Shape_element (if it is either spherical or can be described as a surface of revolution). For a spherical Shape_element, the cross-sectional elements pass through the centre of the sphere. For a surface of revolution, the cross-sectional elements are taken normal to the axis of revolution. Each circular element must lie within its tolerance zone. The Tolerance_zone_boundary (see 4.2.734) consists of two concentric, coplanar circles. For a surface of revolution or spherical Shape_element the Circularity_tolerance defines a Tolerance_-zone (see 4.2.732) that is representative of the tolerance zone for each of the cross-sectional elements.

NOTE 1 Circularity_tolerance is defined in terms of tolerance zone definitions in 14.3 of ISO 1101.

NOTE 2 The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

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Constraints:

WR1: The Shape_element specified by the toleranced_shape_element shall be a Physical_feature_or_-part_template.

WR2: The Circularity_tolerance shall not be a Geometric_tolerance_with_applied_material_condition_-property.

WR3: The Circularity_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_-boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_-with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_size.

IP1: The form of the toleranced Physical_feature_or_part_template shall be consistent with the form of a feature for which the application of a circularity tolerance is sensible.

4.2.80 Closed_curve

A Closed_curve is a type of Curve (see 4.2.165) that is traced by a moving point that returns to an arbitrary starting Cartesian_point (see 4.2.67).

Constraints:

IP1: A Closed_curve shall not be self intersecting.

4.2.81 Common_datum

A Common_datum is a type of Datum (see 4.2.176) that is established by two or more Datum_feature (see 4.2.188).

NOTE Common datums are described in 6.2.2 of ISO 5459.

Constraints:

WR1: Each Common_datum shall participate in establishing at least one Datum_system.

WR2: Each Common_datum shall be specified as the relating_shape_element by two or more Datum_-feature_usage_in_common_datum_relationship.

4.2.82 Component_2d_edge_location

A Component_2d_edge_location is a type of Component_2d_location (see 4.2.83). The Component_-2d_edge_location places components on the edge of a substrate in order to maintain contact with both the top and bottom circuitry.

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NOTE Connection_zone_interface_plane_relationship (see 4.2.149) and Connection_zone_based_assembly_-joint (see 4.2.148) may be used to provide more details if needed by a receiving organization.

The data associated with a Component_2d_edge_location are the following:

— reference_terminal_assembly_joint.

4.2.82.1 reference_terminal_assembly_joint

The reference_terminal_assembly_joint specifies the Assembly_joint (see 4.2.32) that joins the Primary_reference_terminal (see 4.2.571) of the component being located to the associated mating component feature. The surface the mating component feature is associated with is part of the orientation description for the Component_2d_edge_location.

Constraints:

WR1: The mounting_surface inherited from Component_2d_location shall exist and shall be defined by an Interconnect_module_edge_segment_surface (see 4.2.380).

4.2.83 Component_2d_location

A Component_2d_location is a type of Managed_design_object (see 4.2.431). A Component_2d_location may be a Component_2d_edge_location (see 4.2.82). The Component_2d_location is the placement location, including orientation, specified by a combination of description characteristics, substrate surface identification, and two-dimensional transformation. This Application Object requires Component_-assembly_2d_position (see 4.2.85) for completeness.

NOTE This application object includes sufficient information to accurately determine machine parameters for reliable installation of a component on an interconnect substrate.

The data associated with a Component_2d_location are the following:

— mounting_surface;

— placement_fixed;

— transformation.

4.2.83.1 mounting_surface

The mounting_surface specifies the role of the Interconnect_module_component_surface_feature for the Component_2d_location. The mounting_surface need not be specified for the Component_2d_location, due to the fact that mounting_surface is not used in interconnect design.

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NOTE This is usually equivalent to one entire side of the Interconnect_module_component. Special mounting arrangements are indicated by other values of this attribute. The exact value of the surface is specified by the mounting_surface definition associated with the Interconnect_module_usage_view that defines the associated Interconnect_module_component.

4.2.83.2 placement_fixed

The placement_fixed specifies whether or not the Component_2d_location is fixed in the design. A value of TRUE indicates that the Component_2d_location is fixed; a value of FALSE indicates that the Component_2d_location is not fixed.

4.2.83.3 transformation

The transformation specifies the role of the Cartesian_transformation_operator_2d (see 4.2.68) for the Component_2d_location.

Constraints:

IP1: The mounting_surface shall determine the mirroring value with the constraint that mirroring shall mirror only about the local Y axis. The transformation matrix value of +1.0 shall indicate top mounted component (un-mirrored). The transformation matrix value of -1.0 shall indicate bottom mounted component (mirrored). A mirror requirement to mirror about the local Y axis indicates that values on the Y axis are invariant, while values on the X axis are assigned the negative of the original value.

EXAMPLE 1 A point at (X = 3,Y = 2) would be at (X = -3,Y = 2) after being mirrored.

NOTE This standard does not support a "mounting style" attribute. Components which are altered from their normal mounting arrangement (e.g., "upside down mounting style") are considered to be Altered_packaged_part (see 4.2.7) in the context of this standard if the normal mounting arrangement is available and a relationship to that normal mounting arrangement is desired.

IP2: The scale value for the transformation shall be one.

IP3: A seating plane shall be provided in the definition of the component.

IP4: If the design view is an interconnect design, the mounting_surface shall not exist.

IP5: If the design view is an assembly design, the mounting_surface shall exist.

4.2.84 Component_3d_location

A Component_3d_location is a type of Managed_design_object (see 4.2.431). A Component_3d_location is the translation and orientation in three dimensions for the positioning of the Assembly_component (see 4.2.27). This Application Object requires Component_assembly_3d_position (see 4.2.86) for completeness.

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The data associated with a Component_3d_location are the following:

— transformation;

— placement_fixed.

4.2.84.1 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Component_3d_-location.

4.2.84.2 placement_fixed

The placement_fixed specifies whether or not the Component_3d_location is fixed. A value of TRUE indicates that the Component_3d_location is fixed. A value of FALSE indicates that the Component_-3d_location is not fixed.

4.2.85 Component_assembly_2d_position

A Component_assembly_2d_position is a type of Managed_design_object (see 4.2.431). A Compo-nent_assembly_2d_position is the placement and orientation for the positioning of the Assembly_com-ponent_2d_shape (see 4.2.28) in the Physical_unit_planar_shape (see 4.2.536) specified by the Next_-higher_assembly_relationship (see 4.2.454).

The data associated with a Component_assembly_2d_position are the following:

— assembly_model;

— component;

— component_model;

— transformation.

4.2.85.1 assembly_model

The assembly_model specifies the role of the Physical_unit_planar_shape (see 4.2.536) for the Compo-nent_assembly_2d_position.

4.2.85.2 component

The component specifies the role of the Next_higher_assembly_relationship (see 4.2.454) for the Com-ponent_assembly_2d_position. The Next_higher_assembly_relationship specifies the actual component being placed.

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4.2.85.3 component_model

The component_model specifies the role of the Assembly_component_2d_shape (see 4.2.28) for the Component_assembly_2d_position.

4.2.85.4 transformation

The transformation specifies the role of the Component_2d_location (see 4.2.83) for the Component_assembly_2d_position.

NOTE This application object is included to support exchange where a CAD geometric model is constrained to be two-dimensional models, and there is additional non-geometric characteristic information available.

4.2.86 Component_assembly_3d_position

A Component_assembly_3d_position is a type of Managed_design_object (see 4.2.431). A Component_assembly_3d_position is the placement location and orientation in three dimensions for the positioning of the Assembly_component_3d_shape (see 4.2.29) in the Physical_unit_3d_shape (see 4.2.534) specified by the Next_higher_assembly_relationship (see 4.2.454).

The data associated with a Component_assembly_3d_position are the following:

— assembly_model;

— component;

— component_model;

— transformation.

4.2.86.1 assembly_model

The assembly_model specifies the role of the Physical_unit_3d_shape (see 4.2.534) for the Component_assembly_3d_position.

4.2.86.2 component

The component specifies the role of the Next_higher_assembly_relationship (see 4.2.454) for the Component_assembly_3d_position. The Next_higher_assembly_relationship specifies the actual component being placed.

4.2.86.3 component_model

The component_model specifies the role of the Assembly_component_3d_shape (see 4.2.29) for the Component_assembly_3d_position.

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4.2.86.4 transformation

The transformation specifies the role of the Component_3d_location (see 4.2.84) for the Component_-assembly_3d_position.

4.2.87 Component_based_annotation_symbol_placement_relationship

A Component_based_annotation_symbol_placement_relationship is a type of Component_feature_to_-layout_feature_relationship (see 4.2.94). A Component_based_annotation_symbol_placement_relationship is the information that identifies a Special_symbol_laminate_component (see 4.2.667) and is to be placed in the context of the design. This information overrides any such information that may be provided in the library.

The data associated with a Component_based_annotation_symbol_placement_relationship are the following:

— related_stratum_concept.

NOTE This information is used to provide a means to reposition occurrences of polarization etch symbols, such as are used for polarized capacitors and diodes. The placement information is provided by the Next_higher_-assembly_relationship for the occurrence of the etch symbol.

4.2.87.1 related_stratum_concept

The related_stratum_concept specifies the role of the Special_symbol_laminate_component (see 4.2.667) for the Component_based_annotation_symbol_placement_relationship.

4.2.88 Component_based_annotation_text_relationship

A Component_based_annotation_text_relationship is a type of Component_feature_to_layout_feature_-relationship (see 4.2.94). A Component_based_annotation_text_relationship is the information that specifies an explicit text message based on the component, where the message content is either the value of the reference to the component's locator or the value of the terminal pin identifier.

NOTE This information permits product data stored in standard exchange files to serve as messages that are presented to the user in the medium of the Stratum (see 4.2.677), such as the text of the locator reference or the terminal pin name. This information is not intended to be populated for general etched characters on the board.

The data associated with a Component_based_annotation_text_relationship are the following:

— message_type;

— related_stratum_concept.

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4.2.88.1 message_type

The message_type specifies either a component locator reference or a terminal locator for the Component_based_annotation_text_relationship. The message_type is a discriminator for determining which data to use from the attribute relating_feature that is inherited from the Application Object Component_feature_to_layout_feature_relationship (see 4.2.94) . The useful options are either Component_external_reference (see 4.2.89) or Component_feature_external_reference (see 4.2.91). Either of these options will require a query based on the attribute assembly_design_requirement of the design which this Component_feature_to_layout_feature_relationship is helping to define. For the component locator reference option, two additional queries are required, one to determine the Next_higher_assembly_relationship (see 4.2.454) and the second to determine the Assembly_component (see 4.2.27). The component locator reference is the attribute reference_designation of the returned instance of Next_higher_assembly_relationship. The string content of that attribute shall be the string content of the message of the related_stratum_concept. For the terminal locator option, additional queries are necessary, continuing with the Assembly_component and terminating at the relevant Part_terminal_external_reference (see 4.2.503) with an intermediate query of Component_feature (see 4.2.90). The string content of the name attribute of Part_terminal_external_reference shall be the string content of the message of the related_stratum_concept.

NOTE 1 The attribute message_type is not a value of data. It is a declaration of the type of Component_based_annotation_text_relationship.

NOTE 2 The data contained in the reference_designation attribute in a member of Next_higher_assembly_relationship (see 4.2.454) is an instance of a message of one type.

NOTE 3 The data contained in the name attribute in a member of Package_terminal (see 4.2.472) is an instance of a message of the second type.

4.2.88.2 related_stratum_concept

The related_stratum_concept specifies the role of the Laminate_text_string_component (see 4.2.406) for the Component_based_annotation_text_relationship. There is no explicit geometric relationship defined in this part of ISO 10303 between the design element referenced by the message presented by the related_stratum_concept and the related_stratum_concept itself. Only the related_stratum_concept is positioned in the current design. The component or feature referenced by the message in the attribute related_stratum_concept is defined in a different design that is an Assembly_module (see 4.2.34).

NOTE This is the actual physical message, as realized by the fabrication process. The position of the corresponding elements in the two designs are usually defined by an end user using a layout tool which presents a view of the data from the assembly in the layout tool for design efficiency.

4.2.89 Component_external_reference

A Component_external_reference is a type of Managed_design_object (see 4.2.431). A Component_external_reference is an unambiguous reference to a Next_higher_assembly_relationship (see 4.2.454) in a different design.

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EXAMPLE 1 Items in an Interconnect_module (see 4.2.372) design view may need to reference component to assembly relationships in the assembly in order to unambiguously identify source of layout requirements.

The data associated with a Component_external_reference are the following:

— design_owner;

— part_number;

— revision_code;

— product_definition_id;

— reference_designation.

4.2.89.1 design_owner

The design_owner specifies one role of a string for the Component_external_reference.

4.2.89.2 part_number

The part_number specifies one role of a string for the Component_external_reference.

4.2.89.3 revision_code

The revision_code specifies one role of a string for the Component_external_reference.

4.2.89.4 product_definition_id

The product_definition_id specifies one role of a string for the Component_external_reference.

4.2.89.5 reference_designation

The reference_designation specifies one role of a string for the Component_external_reference.

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4.2.90 Component_feature

A Component_feature is a type of Managed_design_object (see 4.2.431). A Component_feature may be one of a Component_interface_terminal (see 4.2.97), a Component_terminal (see 4.2.105), a Component_termination_passage_interface_terminal (see 4.2.114), a Land_interface_terminal (see 4.2.408), a Non_functional_land_interface_terminal (see 4.2.458), or a Printed_connector_component_interface_terminal (see 4.2.576), and in addition may be a Physical_component_feature (see 4.2.519), and in addition may be an Interconnect_module_component_surface_feature (see 4.2.375). The location of the Component_feature in the assembly model is derived from the placement of the associated_component in the assembly model and the placement of the definition model in the usage_definition model of that associated_component.

The data associated with a Component_feature are the following:

— associated_component;

— defined_product_feature;

— definition.

4.2.90.1 associated_component

The associated_component specifies the role of the Assembly_component (see 4.2.27) for the Component_feature.

NOTE The subtypes of Component_feature specify specializations of Assembly_component that are consistent with the subtype of definition.

4.2.90.2 defined_product_feature

The defined_product_feature is an inverse relationship that specifies that there shall be no more than one Component_feature_to_physical_usage_view_assignment (see 4.2.95) that specifies the Component_feature as its assigned_design_object. The defined_product_feature need not be specified for a particular Component_feature.

4.2.90.3 definition

The definition specifies either a Component_termination_passage_template_terminal (see 4.2.119), a Land_template_terminal (see 4.2.413), a Part_feature (see 4.2.494), a Part_terminal_external_reference (see 4.2.503), a Printed_part_template_terminal (see 4.2.586), or a Via_template_terminal (see 4.2.767) for this Component_feature. The definition need not be specified for a particular Component_feature.

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Constraints:

UR1: The combination of the definition and the associated_component shall be unique within a population of Component_features.

WR1: The Physical_unit or Part_template specified by the associated_component as its usage_definition shall be the same Physical_unit or Part_template specified by the definition as its associated_definition.

WR2: For each Component_feature there shall be no more than one Assembly_joint that specifies it as an assembly_feature.

NOTE Parameters may be assigned to Component_feature by the Planned_characteristic object through the Assembly_requirements_allocation.

4.2.91 Component_feature_external_reference

A Component_feature_external_reference is a type of Managed_design_object (see 4.2.431). A Component_feature_external_reference is an unambiguous reference to a Component_feature (see 4.2.90) in a different design.

EXAMPLE 1 Items in an Interconnect_module (see 4.2.372) design view may need to reference component features in a reference assembly in order to unambiguously identify source of layout requirements.

The data associated with a Component_feature_external_reference are the following:

— associated_component;

— name.

4.2.91.1 associated_component

The associated_component specifies the role for a Component_external_reference (see 4.2.89) for the Component_feature_external_reference.

4.2.91.2 name

The name specifies the role of a string for the Component_feature_external_reference.

Constraints:

UR1: Each member of Component_feature_external_reference shall have a unique combination of attributes.

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4.2.92 Component_feature_make_from_relationship

A Component_feature_make_from_relationship is a type of Managed_design_object (see 4.2.431). A Component_feature_make_from_relationship is an association between two Component_feature (see 4.2.90), where one Component_feature is used as a basis for the development of another Component_feature.

The data associated with a Component_feature_make_from_relationship are the following:

— resultant_feature;

— reusable_feature.

4.2.92.1 resultant_feature

The resultant_feature specifies the Component_feature (see 4.2.90) that results from modifying or reusing the reusable_feature in the Component_feature_make_from_relationship.

4.2.92.2 reusable_feature

The reusable_feature specifies the Component_feature (see 4.2.90) that is modified or reused to become the resultant_feature in the Component_feature_make_from_relationship.

Constraints:

WR1: The resultant_feature shall not be the reusable_feature either directly or indirectly.

WR2: The type of the resultant_feature shall be the same as the type of the reusable_feature.

4.2.93 Component_feature_relationship

A Component_feature_relationship is a type of Managed_design_object (see 4.2.431). A Component_feature_relationship is the association between two Component_feature (see 4.2.90).

The data associated with a Component_feature_relationship are the following:

— related_component_feature;

— relating_component_feature.

4.2.93.1 related_component_feature

The related_component_feature specifies the dependent Component_feature (see 4.2.90) for the Component_feature_relationship.

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4.2.93.2 relating_component_feature

The relating_component_feature specifies the independent Component_feature (see 4.2.90) for the Component_feature_relationship.

Constraints:

WR1: The related_component_feature shall not be the relating_component_feature either directly or indirectly.

4.2.94 Component_feature_to_layout_feature_relationship

A Component_feature_to_layout_feature_relationship is a type of Managed_design_object (see 4.2.431). A Component_feature_to_layout_feature_relationship may be a Component_based_annotation_symbol_placement_relationship (see 4.2.87) or a Component_based_annotation_text_relationship (see 4.2.88). A Component_feature_to_layout_feature_relationship is the association between a component or feature of a component and a layout feature, based upon a requirement. All features related with this relationship shall be in the same design unless the reference is to a Component_external_reference (see 4.2.89) or to a Component_feature_external_reference (see 4.2.91).

The data associated with a Component_feature_to_layout_feature_relationship are the following:

— related_stratum_concept;

— relating_feature;

— requirement.

4.2.94.1 related_stratum_concept

The related_stratum_concept specifies either an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum (see 4.2.677), a Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) to which the relating_feature is related for the Component_feature_to_layout_feature_relationship.

4.2.94.2 relating_feature

The relating_feature specifies an Assembly_component (see 4.2.27) or a Component_feature (see 4.2.90) or a Component_feature_external_reference or a Component_external_reference for the Component_feature_to_layout_feature_relationship.

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4.2.94.3 requirement

The requirement specifies the Ee_requirement_occurrence (see 4.2.283) that causes this Component_feature_to_layout_feature_relationship to be needed. The requirement need not be specified for a particular Component_feature_to_layout_feature_relationship.

4.2.95 Component_feature_to_physical_usage_view_assignment

A Component_feature_to_physical_usage_view_assignment is a type of Managed_design_object (see 4.2.431). A Component_feature_to_physical_usage_view_assignment is the association between the Part_feature (see 4.2.494) and the Component_feature (see 4.2.90). The purpose for this assignment is to link the product data in the design view to the product data in the usage view for traceability purposes.

NOTE 1 In an archive, both a design view and a usage view are archived together, with this relationship populated as necessary to provide linkages between the features in the usage view and the features in the design view. Without this linkage populated, there is no way to guarantee traceability between a design view and a usage view, without evaluating the design view and the usage view in detail.

NOTE 2 In the case where this part of ISO 10303 is used to exchange or store designs that may be used in higher level assemblies, the usage view is provided to the designers of those higher level assemblies, and this entity allows the interface definitions to the next level assemblies to be carefully controlled. Note that the usage view is an as-designed view. The requirements unit of functionality in this part of ISO 10303 supports the as-required view of the interface to the next higher assembly in a top-down design paradigm. This part of ISO 10303 supports explicitly exchanging those data separately so that traceability is provided from requirements to as-designed life-cycle states in the same exchange file.

NOTE 3 This information is provided for the case where a Component_feature is suitable directly as a feature of the assembly.

NOTE 4 Most Component_feature types will be interface types.

The data associated with a Component_feature_to_physical_usage_view_assignment are the following:

— assigned_design_object;

— defined_part_feature.

4.2.95.1 assigned_design_object

The assigned_design_object specifies the role of the Component_feature (see 4.2.90) for the Component_feature_to_physical_usage_view_assignment.

4.2.95.2 defined_part_feature

The defined_part_feature specifies the role of the Part_feature (see 4.2.494) for the Component_feature_-to_physical_usage_view_assignment.

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4.2.96 Component_group_assignment

A Component_group_assignment is a type of Managed_design_object (see 4.2.431). A Component_-group_assignment is the relationship between an Assembly_component (see 4.2.27) and the Placement_-group (see 4.2.539) to which it is assigned. A Component_group_assignment is an incomplete concept by itself and is intended for use with a Placement_group_area_assignment (see 5.2.4.320) or a Component_-placement_restriction_assignment (see 5.2.4.374).

The data associated with a Component_group_assignment are the following:

— assigned_component;

— associated_group.

4.2.96.1 assigned_component

The assigned_component specifies the Assembly_component (see 4.2.27) in the Component_group_-assignment.

4.2.96.2 associated_group

The associated_group specifies the Placement_group (see 4.2.539) in the Component_group_assignment.

4.2.97 Component_interface_terminal

A Component_interface_terminal is a type of Component_feature (see 4.2.90). A Component_inter-face_terminal is one of an Interconnect_component_interface_terminal (see 4.2.370) or a Packaged_-connector_component_interface_terminal (see 4.2.479). A Component_interface_terminal is one termi-nation of an interface component.

EXAMPLE 1 An example of this is one terminal on a socket or connector, available for mating to a terminal of an external connector or to a terminal of a component installed in the socket.

The data associated with a Component_interface_terminal are the following:

— associated_component.

4.2.97.1 associated_component

The associated_component specifies the role of the Interface_component (see 4.2.390) for the Compo-nent_interface_terminal.

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4.2.98 Component_make_from_relationship

A Component_make_from_relationship is a type of Managed_design_object (see 4.2.431). A Component_make_from_relationship is the association between one Assembly_composition_relationship (see 4.2.30) and another Assembly_composition_relationship, where one Assembly_composition_relationship results from full or partial reuse of the other.

NOTE The main use of this concept is design reuse where the modification consists of the fact that the Assembly_composition_relationship is in a different assembly from the original design.

The data associated with a Component_make_from_relationship are the following:

— resultant_component;

— reusable_component.

4.2.98.1 resultant_component

The resultant_component specifies the Assembly_composition_relationship (see 4.2.30) for the Assembly_component (see 4.2.27) that results from the reuse of the reusable_component in the Component_make_from_relationship.

4.2.98.2 reusable_component

The reusable_component specifies the Assembly_composition_relationship (see 4.2.30) for the Assembly_component (see 4.2.27) that is reused to create the resultant_component in the Component_make_from_relationship.

Constraints:

WR1: The reusable_component shall not be an ancestor, either directly or indirectly of the resultant_component. The inverse shall also be true.

WR2: The reusable_component shall not be the resultant_component.

4.2.99 Component_mounting_clearance_relationship

A Component_mounting_clearance_relationship is a type of Managed_design_object (see 4.2.431). A Component_mounting_clearance_relationship is the relationship between one component and another in their next assembly, with respect to the clearance between them.

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NOTE 1 This clearance is required when a specific component requires a minimum distance from the printed circuit board or another specific component.

NOTE 2 This clearance is often derived from the mechanism requirements of the factory equipment that assembles the components to their next assembly. The mechanical handling fingers that grasp and place a component require clearance from previously placed components in order to place the second component and release it from the mechanism.

The data associated with a Component_mounting_clearance_relationship are the following:

— current_component;

— maximum_mounting_clearance;

— minimum_mounting_clearance;

— previously_placed_component.

4.2.99.1 current_component

The current_component specifies the Next_higher_assembly_relationship (see 4.2.454) of the component to be placed for the Component_mounting_clearance_relationship.

4.2.99.2 maximum_mounting_clearance

The maximum_mounting_clearance specifies the Length_data_element (see 4.2.422), of the maximum distance between the current_component and the previously_placed_component, for the Component_mounting_clearance_relationship. The maximum_mounting_clearance need not be specified for a particular Component_mounting_clearance_relationship. The value shall be interpreted as the specification to be satisfied by the assembly process.

4.2.99.3 minimum_mounting_clearance

The minimum_mounting_clearance specifies the Length_data_element (see 4.2.422), of the minimum distance between the current_component and the previously_placed_component, for the Component_mounting_clearance_relationship. The value shall be interpreted as the specification to be satisfied by the assembly process.

4.2.99.4 previously_placed_component

The previously_placed_component specifies the Next_higher_assembly_relationship (see 4.2.454), of the component previously placed, for the Component_mounting_clearance_relationship.

NOTE The previously_placed_component may be the printed wiring board.

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Constraints:

WR1: A previously_placed_component shall not be the current_component.

WR2: A Datum_plane shall be defined for each of the current_component and of the previously_-placed_component.

WR3: The length shall be measured between the two Datum_planes.

WR4: Both components shall be in the same version of the product.

WR5: Each Datum_plane shall be based on physical features of the component.

4.2.100 Component_overlap_relationship

A Component_overlap_relationship is a type of Managed_design_object (see 4.2.431). A Component_-overlap_relationship is the relationship between one component and another in their next assembly, with respect to the physical overlap between them. This overlap is often derived from the mechanism requirements of the factory equipment that assembles the components to their next assembly. The sequence of assembly is established by the previously_placed_component and the current_component, in turn, and the minimum clearance between the two components is taken into consideration during assembly.

The data associated with a Component_overlap_relationship are the following:

— current_component;

— maximum_added_clearance;

— minimum_added_clearance;

— previously_placed_component.

4.2.100.1 current_component

The current_component specifies the Next_higher_assembly_relationship (see 4.2.454), of the component to be placed next, for the Component_overlap_relationship.

4.2.100.2 maximum_added_clearance

The maximum_added_clearance specifies the Length_data_element (see 4.2.422) of the maximum distance between the current_component and the previously_placed_component for the Component_overlap_relationship. The maximum_added_clearance need not be specified for a particular Component_-overlap_relationship.

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4.2.100.3 minimum_added_clearance

The minimum_added_clearance specifies the Length_data_element (see 4.2.422) of the minimum distance between the current_component and the previously_placed_component for the Component_overlap_relationship.

4.2.100.4 previously_placed_component

The previously_placed_component specifies the Next_higher_assembly_relationship (see 4.2.454), of the component previously placed for the Component_overlap_relationship.

Constraints:

WR1: The previously_placed_component shall not be the current_component.

WR2: Both components shall be in the same version of the assembly.

WR3: A Datum_plane shall be defined for each of the current_component and previously_placed_component.

WR4: The length shall be measured between the two Datum_planes.

WR5: Each Datum_plane shall be based on a physical feature of the component.

4.2.101 Component_part_2d_geometric_representation_relationship

A Component_part_2d_geometric_representation_relationship is a type of Managed_design_object (see 4.2.431). A Component_part_2d_geometric_representation_relationship is the association between a Part_template_planar_shape (see 5.2.4.314) or a Physical_unit_planar_shape (see 4.2.536) and the Assembly_component_2d_shape (see 4.2.28) that is the occurrence of that planar shape. If the type of the shape representation of the assembly is different from the type of the shape representation of the part, the Component_part_2d_geometric_representation_relationship allows a processor to create a shape rep of the assembly type and establish an equivalency relationship between that shape representation and the part shape representation. If the shape representation of the assembly is of the same type as the part shape representation, the Component_part_2d_geometric_representation_relationship shall reference the same shape representation as both the part_shape and the component_shape.

The data associated with a Component_part_2d_geometric_representation_relationship are the following:

— component_shape;

— part_shape.

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4.2.101.1 component_shape

The component_shape specifies the role of the Assembly_component_2d_shape (see 4.2.28) for the Component_part_2d_geometric_representation_relationship.

4.2.101.2 part_shape

The part_shape specifies either the Part_template_planar_shape (see 5.2.4.314) or the Physical_unit_planar_shape (see 4.2.536) for the Component_part_2d_geometric_representation_relationship.

4.2.102 Component_part_3d_geometric_representation_relationship

A Component_part_3d_geometric_representation_relationship is a type of Managed_design_object (see 4.2.431). A Component_part_3d_geometric_representation_relationship is the association between a Part_template_3d_shape (see 5.2.4.108) or a Physical_unit_3d_shape (see 4.2.534) and the Assembly_component_3d_shape (see 4.2.29) that is the occurrence of the three-dimensional shape. If the type of the shape representation of the assembly is different from the type of the shape representation of the part, the Component_part_3d_geometric_representation_relationship allows a processor to create a shape rep of the assembly type and establish an equivalency relationship between that shape representation and the part shape representation. If the shape representation of the assembly is of the same type as the part shape representation, the Component_part_3d_geometric_representation_relationship shall reference the same shape representation as both the part_shape and the component_shape.

The data associated with a Component_part_3d_geometric_representation_relationship are the following:

— component_shape;

— part_shape.

4.2.102.1 component_shape

The component_shape specifies the role of the Assembly_component_3d_shape (see 4.2.29) for the Component_part_3d_geometric_representation_relationship.

4.2.102.2 part_shape

The part_shape specifies the Part_template_3d_shape (see 5.2.4.108), or the Part_template_non_planar_2d_shape (see 5.2.4.375), or the Physical_unit_3d_shape (see 4.2.534) for the Component_part_3d_geometric_representation_relationship.

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4.2.103 Component_placement_restriction_assignment

A Component_placement_restriction_assignment is a type of Managed_design_object (see 4.2.431). A Component_placement_restriction_assignment is the relationship between the area of an entire Interconnect_module_component (see 4.2.373) or a portion thereof and restrictions to placement of other components in that area due to an item in the design. The context of a Component_placement_restriction_assignment is the design of the assembly within which both the Interconnect_module_component and associated components are identified.

The data associated with a Component_placement_restriction_assignment are the following:

— area;

— components_permitted;

— maximum_mounting_clearance;

— maximum_negative_component_height;

— maximum_positive_component_height;

— minimum_mounting_clearance;

— requirement.

4.2.103.1 area

The area specifies the role of the Mounting_restriction_area (see 5.2.4.14) for the Component_placement_restriction_assignment. The area is an area on an Interconnect_module_component.

4.2.103.2 components_permitted

The components_permitted specifies whether or not there is a restriction upon placement of components in an area for the Component_placement_restriction_assignment. The value of TRUE states that components are permitted; the value of FALSE states that components are not permitted to be placed in the defined area.

4.2.103.3 maximum_mounting_clearance

The maximum_mounting_clearance specifies the largest Datum_based_length_measure (see 4.2.181) for which the Component_placement_restriction_assignment is made. The maximum_mounting_clearance need not be specified for a particular Component_placement_restriction_assignment.

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EXAMPLE 1 An example of the maximum_mounting_clearance attribute is for a printed circuit assembly with through-hole components, where some packages are required to be mounted other than flush with the surface of the printed circuit board, for purposes of cleaning or of thermal dissipation. The maximum_mounting_clearance is less frequently seen than the minimum_mounting_clearance, but it is included for completeness. When a maximum dimension is required, it is often described by the maximum_positive_component_height attribute, which takes into consideration the maximum material condition of the package as well as the clearance from the printed circuit board.

4.2.103.4 maximum_negative_component_height

The maximum_negative_component_height specifies the largest Datum_based_length_measure (see 4.2.181) in the negative direction from that Datum (see 4.2.176), for which the Component_placement_restriction_assignment is made. The maximum_negative_component_height need not be specified for a particular Component_placement_restriction_assignment.

EXAMPLE 1 An example of the maximum_negative_component_height attribute is a printed circuit assembly with through-hole components, where the maximum lead protrusion dimension is given. That dimension is the maximum_negative_component_height. Another example of the maximum_negative_component_height attribute is a printed circuit assembly with surface mounted components on both sides. The maximum_negative_component_height attribute is the distance between the established datum and the maximum material condition of the vertical dimension of the highest surface mount component on the secondary side of the printed circuit assembly.

4.2.103.5 maximum_positive_component_height

The maximum_positive_component_height specifies the largest Datum_based_length_measure (see 4.2.181) in the positive direction from the Datum (see 4.2.176), for which the Component_placement_restriction_assignment is made. The maximum_positive_component_height need not be specified for a particular Component_placement_restriction_assignment.

EXAMPLE 1 An example of the maximum_positive_component_height attribute is a printed circuit assembly where the maximum component height in the positive direction relative to a datum is given. This dimension pertains to the fit of the printed circuit assembly in its next assembly. That dimension is the maximum_positive_component_height.

4.2.103.6 minimum_mounting_clearance

The minimum_mounting_clearance specifies the smallest Datum_based_length_measure (see 4.2.181) for which the Component_placement_restriction_assignment is made. The minimum_mounting_clearance need not be specified for a particular Component_placement_restriction_assignment.

EXAMPLE 1 An example of the minimum_mounting_clearance attribute is for a printed circuit assembly with through-hole components, where some packages are required to be mounted other than flush with the surface of the printed circuit board for purposes of cleaning or of thermal dissipation. The minimum_mounting_clearance is more frequently seen than the maximum_mounting_clearance. The usual default clearance dimension is zero, meaning that the component package is intended to be mounted flush with the printed circuit board. Packages that often require a minimum_mounting_clearance include radial capacitors and certain other devices where the leads protrude from the bottom of the package, and where the package is not usually intended to be bonded directly to the printed circuit board.

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4.2.103.7 requirement

The requirement specifies the role of the Item_restricted_requirement_occurrence (see 5.2.4.9) for the Component_placement_restriction_assignment.

Constraints:

WR1: The direction of negative measurement is antiparallel to the normal of the surface of the Interconnect_module_component specified by area.mounting_surface.

WR2: The direction of positive measurement is parallel to the normal of the surface of the Interconnect_module_component specified by area.mounting_surface.

WR3: The location of the Datum for the maximum_mounting_clearance_relationship shall be on the same side of the Interconnect_module_component as that specified by area.mounting_surface.

WR4: The location of the Datum for the minimum_mounting_clearance_relationship shall be on the same side of the Interconnect_module_component as that specified by area.mounting_surface.

4.2.104 Component_swap_specification

A Component_swap_specification is a type of Change_design_object_management_relationship (see 4.2.74). The Component_swap_specification specifies which component has been swapped for which other component in a design; both the swapped-out and the swapped-in components are specified.

NOTE The Component_swap_specification supports the component identification portion of the gate swap specification. It is necessary when components, such as the microcircuits known as U1, U2, etc. are being swapped.

The data associated with a Component_swap_specification are the following:

— current_design_object;

— previous_design_object.

4.2.104.1 current_design_object

The current_design_object specifies the Design_functional_unit_allocation_to_assembly_component (see 5.2.4.187) for the resulting design object after swapping, for the Component_swap_specification.

4.2.104.2 previous_design_object

The previous_design_object specifies the Design_functional_unit_allocation_to_assembly_component (see 5.2.4.187) for the original design object before swapping, for the Component_swap_specification.

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4.2.105 Component_terminal

A Component_terminal is a type of Component_feature (see 4.2.90). A Component_terminal is one of an Assembly_module_component_terminal (see 4.2.36), a Bare_die_component_terminal (see 4.2.49), a Component_termination_passage_join_terminal (see 5.2.4.10), a Conductive_interconnect_element_terminal (see 5.2.4.11), an Interconnect_component_join_terminal (see 4.2.371), an Interconnect_module_component_terminal (see 4.2.376), a Land_join_terminal (see 5.2.4.12), a Non_functional_land_join_terminal (see 5.2.4.13), a Packaged_component_join_terminal (see 4.2.476), a Printed_component_join_terminal (see 5.2.4.109), or a Via_terminal (see 5.2.4.315). A Component_terminal is the defined conductive shape for conductors from other components to access electrical functionality of the Assembly_component (see 4.2.27).

The data associated with a Component_terminal are the following:

— connected_node;

— global_swappable;

— local_swappable;

— node_implementation;

— swap-code.

4.2.105.1 connected_node

The connected_node is an inverse relationship that specifies the Physical_connectivity_definition (see 5.2.4.1) that specifies the Component_terminal as its associated_terminals. There shall be no more than one Physical_connectivity_definition for a Component_terminal. The connected_node need not be specified for a particular Component_terminal.

4.2.105.2 global_swappable

The global_swapable specifies a boolean value that indicates if the terminal can be exchanged within associated functional units of the same type.

4.2.105.3 local_swappable

The local_swappable specifies a boolean value that indicates if the terminal can be exchanged within the associated functional unit.

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4.2.105.4 node_implementation

The node_implementation is an inverse relationship that specifies the Physical_network (see 5.2.4.17) that specifies the Component_terminal as its connectivity_requirement_element. There shall be no more than one Physical_network for a Component_terminal. The node_implementation need not be specified for a particular Component_terminal.

4.2.105.5 swap-code

The swap_code specifies the string that is the type of exchange that is valid.

Constraints:

IP1: Each Component_terminal that is referenced by a Physical_connectivity_definition as an associated_terminal shall not also be in the design view of the implementation of that Physical_connectivity_definition.

IP2: The node_implementation and the connected_node shall not both exist.

4.2.106 Component_terminal_to_assembly_module_terminal_assignment

A Component_terminal_to_assembly_module_terminal_assignment is a type of Managed_design_object (see 4.2.431). A Component_terminal_to_assembly_module_terminal_assignment is the relationship between an Assembly_module_terminal (see 4.2.37) and one of an Assembly_module_component_terminal (see 4.2.36), a Component_interface_terminal (see 4.2.97), or an Interconnect_module_component_terminal (see 4.2.376).

NOTE The purpose of this object is to provide traceability from the data in the design view to the data in the usage view for the design organization for archival purposes.

The data associated with a Component_terminal_to_assembly_module_terminal_assignment are the following:

— assigned_terminal;

— usage_view_terminal.

4.2.106.1 assigned_terminal

The assigned_terminal specifies the role of one of an Assembly_module_component_terminal (see 4.2.36), a Component_interface_terminal (see 4.2.97), or an Interconnect_module_component_terminal (see 4.2.376) for the Component_terminal_to_assembly_module_terminal_assignment.

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4.2.106.2 usage_view_terminal

The usage_view_terminal specifies the role of the Assembly_module_terminal (see 4.2.37) for the Component_terminal_to_assembly_module_terminal_assignment.

Constraints:

UR1: The usage_view_terminal shall be unique within a population of Component_terminal_to_assembly_module_terminal_assignments.

4.2.107 Component_terminal_to_interconnect_module_terminal_assignment

A Component_terminal_to_interconnect_module_terminal_assignment is a type of Managed_design_object (see 4.2.431). A Component_terminal_to_interconnect_module_terminal_assignment is the relationship between an Interconnect_module_terminal (see 5.2.4.211) and one of a Component_termination_passage_interface_terminal (see 4.2.114), a Land_interface_terminal (see 4.2.408), a Non_functional_land_interface_terminal (see 4.2.458), a Printed_connector_component_interface_terminal (see 4.2.576)to provide traceability from the data in the design view to the data in the usage view for the design organization for archival purposes.

The data associated with a Component_terminal_to_interconnect_module_terminal_assignment are the following:

— assigned_terminal;

— usage_view_terminal.

4.2.107.1 assigned_terminal

The assigned_terminal specifies the role of one of a Component_termination_passage_interface_terminal (see 4.2.114), a Land_interface_terminal (see 4.2.408), a Non_functional_land_interface_terminal (see 4.2.458), a Printed_connector_component_interface_terminal (see 4.2.576)for the Component_terminal_to_interconnect_module_terminal_assignment.

4.2.107.2 usage_view_terminal

The usage_view_terminal specifies the role of the Interconnect_module_terminal (see 5.2.4.211) for the Component_terminal_to_interconnect_module_terminal_assignment.

Constraints:

UR1: The usage_view_terminal shall be unique within a population of Component_terminal_to_interconnect_module_terminal_assignments.

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4.2.108 Component_terminal_to_pca_terminal_assignment

A Component_terminal_to_pca_terminal_assignment is a type of Managed_design_object (see 4.2.431). A Component_terminal_to_pca_terminal_assignment is the relationship between a Pca_terminal (see 4.2.511) and one of an Assembly_module_component_terminal (see 4.2.36), a Component_interface_terminal (see 4.2.97), or an Interconnect_module_component_terminal (see 4.2.376), to provide traceability from the data in the design view to the data in the usage view for the design organization for archival purposes.

The data associated with a Component_terminal_to_pca_terminal_assignment are the following:

— assigned_terminal;

— usage_view_terminal.

4.2.108.1 assigned_terminal

The assigned_terminal specifies one of an Assembly_module_component_terminal (see 4.2.36), a Component_interface_terminal (see 4.2.97), or an Interconnect_module_component_terminal (see 4.2.376) for the Component_terminal_to_pca_terminal_assignment.

4.2.108.2 usage_view_terminal

The usage_view_terminal specifies the role of the Pca_terminal (see 4.2.511) for the Component_terminal_to_pca_terminal_assignment.

Constraints:

UR1: The usage_view_terminal shall be unique within a population of Component_terminal_to_pca_terminal_assignments.

4.2.109 Component_termination_passage

A Component_termination_passage is a type of Plated_passage (see 5.2.4.360) through which a Component_terminal (see 4.2.105) may pass. The properties of the Component_termination_passage are selected to support the Component_terminal.

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NOTE 1 The model in this part of ISO 10303 is that the wall of the passage is directly supporting current flow.

NOTE 2 Support for the member of Component_terminal that passes through an Inter_stratum_feature (see 4.2.364) but is not assembled to the wall of that Inter_stratum_feature is provided by the Cutout (see 5.2.4.31) concept.

NOTE 3 Support for the member of Component_terminal that electrically is connected only to the surface of an Interconnect_module (see 4.2.372) is provided by the Land (see 4.2.407) concept.

NOTE 4 There is no requirement for the Component_termination_passage to completely penetrate the interconnect substrate.

EXAMPLE 1 Figure 5.2.4.110 is a detail of a layout drawing that superimposes components from the next level of assembly in order to illustrate the physical relationship of a Component_termination_passage to the terminals of those components. This example omits the details of how this part of ISO 10303 establishes the relationship between the terminal and the passage for clarity.

EXAMPLE 2 Figure 5.2.4.376 is a detail of a cross-section of an interconnect substrate showing a case of complete penetration of the substrate by the Component_termination_passage.

The data associated with a Component_termination_passage are the following:

— access_mechanism;

— interface_access_mechanism;

— usage_definition.

4.2.109.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Component_termination_passage is dependent on the existence of the Component_termination_passage_join_terminal (see 5.2.4.10) that specifies the Component_termination_passage as its associated_component. There shall be one or more Component_termination_passage_join_terminal for a Component_termination_passage.

4.2.109.2 interface_access_mechanism

The interface_access_mechanism is an inverse relationship that specifies that the existence of the Component_termination_passage is dependent on the existence of the Component_termination_passage_interface_terminal (see 4.2.114) that specifies the Component_termination_passage as its associated_component.

4.2.109.3 usage_definition

The usage_definition specifies the role of the Component_termination_passage_template (see 5.2.4.57) for the Component_termination_passage.

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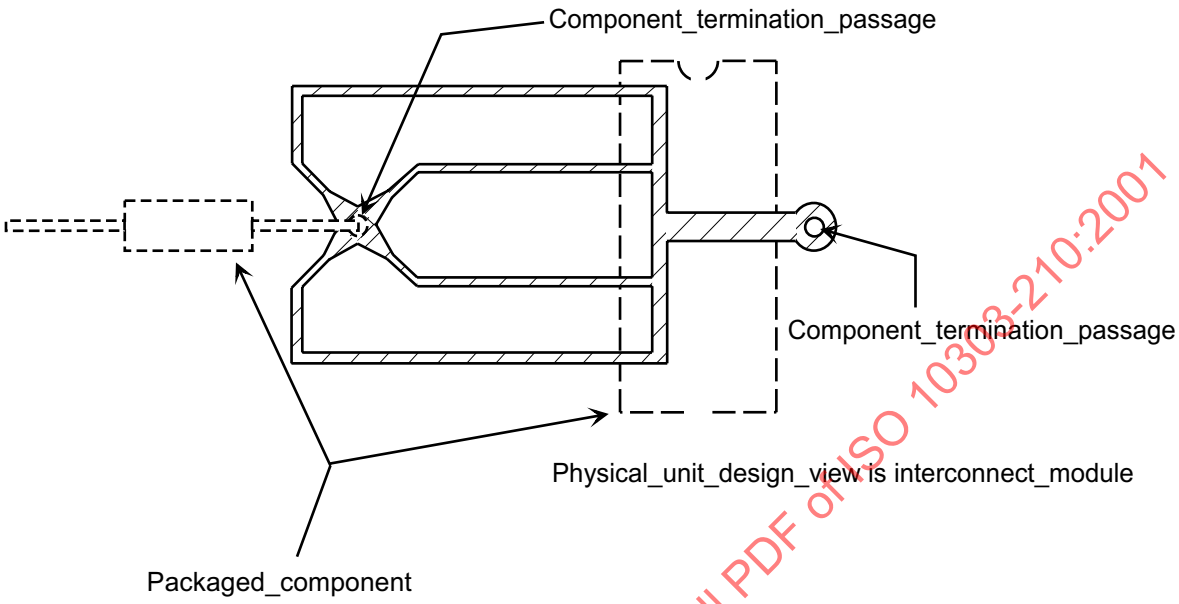

Note : Packaged_component are at next level of product structure.

Figure 15 – Component_termination_passage role in an assembly

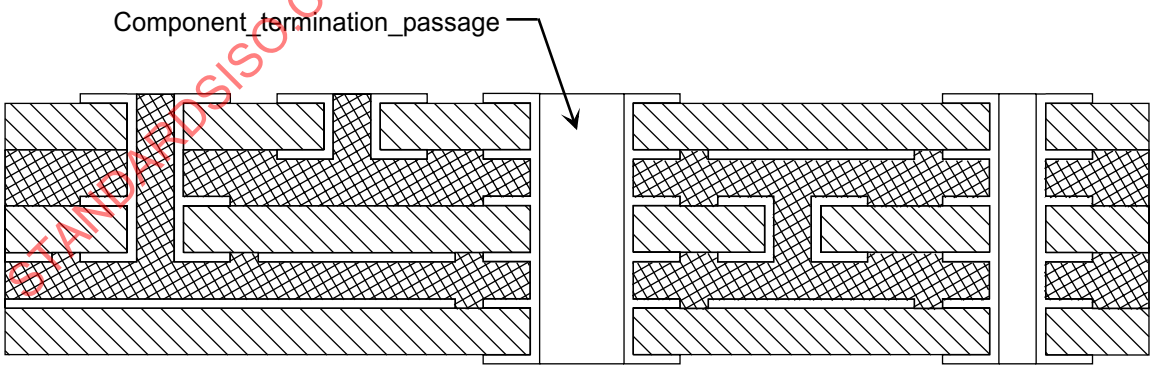

Figure 16 – Component_termination_passage cross-section view

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Constraints:

WR1: A Component_termination_passage shall be a feature of size.

NOTE A Component_termination_passage is a feature of size, because it is part of the interface to another product in the assembly and the size of the passage shall be compatible with the appropriate assembly requirements of that product. Information about the other product's features needed for this function is specified in this part of ISO 10303 in the Default_component_termination_passage_definition specified by usage_definition.of_passage_-technology.

4.2.110 Component_termination_passage_and_contact_size_dependent_land

A Component_termination_passage_and_contact_size_dependent_land is a type of Land (see 4.2.407). The shape of the Component_termination_passage_and_contact_size_dependent_land is dependent both on the passage that is within the shape of the land (where that passage is included for the purpose of connecting the component terminal to a trace on the substrate) and on the size of the terminal that is going to be resting on the board.

NOTE A Component_termination_passage_and_contact_size_dependent_land principally provides a location for the solder joint.

The data associated with a Component_termination_passage_and_contact_size_dependent_land are the following:

— reference_passage;

— usage_definition.

4.2.110.1 reference_passage

The reference_passage specifies the role of the Component_termination_passage (see 5.2.4.227) for the Component_termination_passage_and_contact_size_dependent_land.

4.2.110.2 usage_definition

The usage_definition specifies the role of the Default_attachment_size_and_component_termination_-passage_based_land_physical_template (see 5.2.4.378) for the Component_termination_passage_and_-contact_size_dependent_land.

4.2.111 Component_termination_passage_and_contact_size_dependent_non_functional_land

A Component_termination_passage_and_contact_size_dependent_non_functional_land is a type of Non_-functional_land (see 5.2.4.274). The shape of the Component_termination_passage_and_contact_size_-dependent_non_functional_land is dependent both on the passage that is within the shape of the land (where that passage is included for the purpose of connecting the component terminal to a trace on the substrate) and on the size of the terminal that is going to be resting on the board.

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NOTE A Component_termination_passage_and_contact_size_dependent_non_functional_land principally provides a location for the solder joint.

The data associated with a Component_termination_passage_and_contact_size_dependent_non_functional_land are the following:

— reference_passage;

— usage_definition.

4.2.111.1 reference_passage

The reference_passage specifies the role of the Component_termination_passage (see 5.2.4.227) for the Component_termination_passage_and_contact_size_dependent_non_functional_land.

4.2.111.2 usage_definition

The usage_definition specifies the role of the Default_attachment_size_and_component_termination_-passage_based_land_physical_template (see 5.2.4.378) for the Component_termination_passage_and_-contact_size_dependent_non_functional_land.

4.2.112 Component_termination_passage_dependent_land

A Component_termination_passage_dependent_land is a type of Land (see 4.2.407). The shape of the Component_termination_passage_dependent_land is dependent only on the passage that is within the shape of the land (where that passage is included for the purpose of connecting the component terminal to a trace on the substrate).

The data associated with a Component_termination_passage_dependent_land are the following:

— reference_passage;

— usage_definition.

4.2.112.1 reference_passage

The reference_passage specifies the role of the Component_termination_passage (see 5.2.4.227) for the Component_termination_passage_dependent_land.

4.2.112.2 usage_definition

The usage_definition specifies the role of the Default_component_termination_passage_based_land_-physical_template (see 5.2.4.166) for the Component_termination_passage_dependent_land.

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4.2.113 Component_termination_passage_dependent_non_functional_land

A Component_termination_passage_dependent_non_functional_land is a type of Non_functional_land (see 5.2.4.274). The shape of the Component_termination_passage_dependent_non_functional_land is dependent only on the passage that is within the shape of the land (where that passage is included for the purpose of connecting the component terminal to a trace on the substrate).

The data associated with a Component_termination_passage_dependent_non_functional_land are the following:

— reference_passage;

— usage_definition.

4.2.113.1 reference_passage

The reference_passage specifies the role of the Component_termination_passage (see 5.2.4.227) for the Component_termination_passage_dependent_non_functional_land.

4.2.113.2 usage_definition

The usage_definition specifies the role of the Default_component_termination_passage_based_land_-physical_template (see 5.2.4.166) for the Component_termination_passage_dependent_non_functional_-land.

4.2.114 Component_termination_passage_interface_terminal

A Component_termination_passage_interface_terminal is a type of Component_feature (see 4.2.90). The Component_termination_passage_interface_terminal is the internal wall of the passage only and is the complete internal wall. It does not extend to the exterior top or bottom edges of the passage. It does not include an exterior surface of the passage. This terminal is the definition of an interface mechanism for an interconnect.

NOTE In normal usage, the interior wall has a smaller diameter than the exterior wall.

The data associated with a Component_termination_passage_interface_terminal are the following:

— associated_component;

— definition.

4.2.114.1 associated_component

The associated_component specifies the role of the Component_termination_passage (see 5.2.4.227) for the Component_termination_passage_interface_terminal.

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4.2.114.2 definition

The definition specifies the role of the Component_termination_passage_template_interface_terminal (see 5.2.4.289) for the Component_termination_passage_interface_terminal.

EXAMPLE 1 One use of this capability occurs when a member of Component_feature_to_physical_usage_-view_assignment references a member of Component_termination_passage_interface_terminal.

4.2.115 Component_termination_passage_join_terminal

A Component_termination_passage_join_terminal is a type of Component_terminal (see 4.2.105). The Component_termination_passage_join_terminal is the exterior surface of the passage. The exterior surface has a larger nominal diameter than the interior surface.

NOTE One Component_termination_passage_join_terminal may be related to multiple Land_join_terminals, since each stratum may have a Land (see 4.2.407) associated with the Component_termination_passage (see 5.2.4.227).

The data associated with a Component_termination_passage_join_terminal are the following:

— associated_component;

— definition.

4.2.115.1 associated_component

The associated_component specifies the role of the Component_termination_passage for the Component_termination_passage_join_terminal.

4.2.115.2 definition

The definition specifies the role of the Component_termination_passage_template_join_terminal (see 5.2.4.75) for the Component_termination_passage_join_terminal.

4.2.116 Component_termination_passage_template

A Component_termination_passage_template is a type of Inter_stratum_feature_template (see 5.2.4.76). The Component_termination_passage_template defines all shape data for the associated Component_-termination_passage (for which it is the usage_definition), and also where the connection (dependency) on passage technology is established for the properties.

NOTE Properties other than shape are to be found in the of_passage_technology.

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The data associated with a Component_termination_passage_template are the following:

— access_mechanisms;

— of_passage_technology.

4.2.116.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Component_-termination_passage_template is dependent on the existence of the Component_termination_passage_-template_terminal (see 4.2.119) that specifies the Component_termination_passage_template as its associated_definition. There shall be two or more Component_termination_passage_template_terminals for a Component_termination_passage_template.

4.2.116.2 of_passage_technology

The of_passage_technology specifies the role of the Default_component_termination_passage_definition (see 5.2.4.111) for the Component_termination_passage_template.

Constraints:

WR1: One access_mechanisms shall be a Component_termination_passage_template_interface_terminal.

WR2: One access_mechanisms shall be a Component_termination_passage_template_join_terminal.

4.2.117 Component_termination_passage_template_interface_terminal

A Component_termination_passage_template_interface_terminal is a type of Component_termination_-passage_template_terminal (see 4.2.119), an occurrence of which provides an interface capability to the next level of assembly.

NOTE Use of this capability occurs when a member of Component_feature_to_physical_usage_view_assignment references a member of an occurrence of Component_termination_passage_template_interface_terminal.

EXAMPLE 1 Figure 5.2.4.80 illustrates details related to the definition (in a usage view) and occurrence (in a design view) of the terminals associated with a Component_termination_passage_template.

4.2.118 Component_termination_passage_template_join_terminal

A Component_termination_passage_template_join_terminal is a type of Component_termination_passage_template_terminal (see 4.2.119), an occurrence of which provides a fabrication join capability, within an optionally constrained set of Stratum (see 4.2.677).

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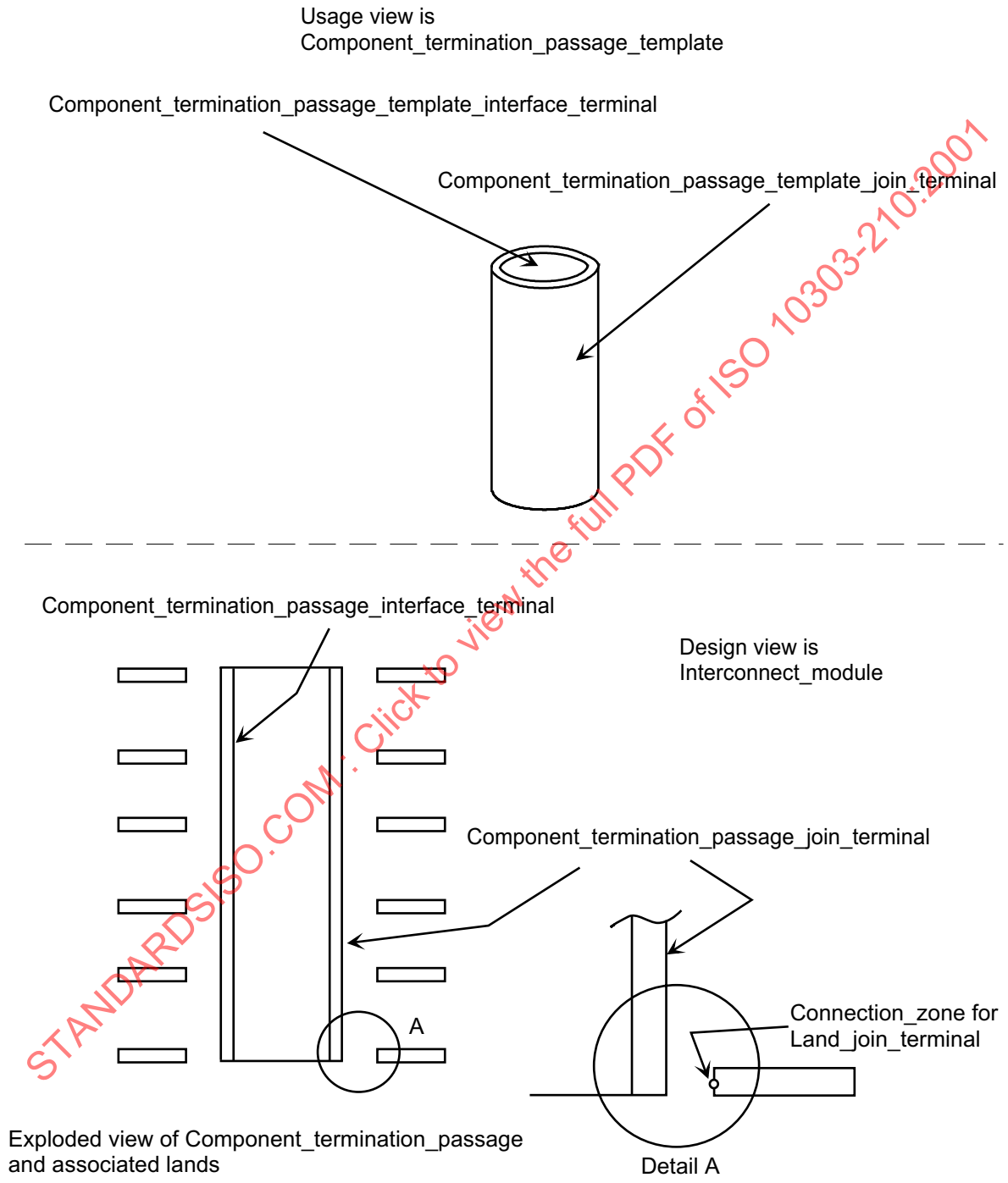

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Figure 17 – Component_termination_passage_template terminals

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The data associated with a Component_termination_passage_template_join_terminal are the following:

— disallowed_inter_stratum_extent.

4.2.118.1 disallowed_inter_stratum_extent

The disallowed_inter_stratum_extent specifies the Inter_stratum_extent (see 5.2.4.83) for which a connection to the Component_termination_passage_template_join_terminal is disallowed. The disallowed_inter_stratum_extent need not be supplied for a Component_termination_passage_template_join_terminal. There may be more than one Inter_stratum_extent for a Component_termination_passage_template_join_terminal.

4.2.119 Component_termination_passage_template_terminal

A Component_termination_passage_template_terminal is a type of Managed_design_object (see 4.2.431). A Component_termination_passage_template_terminal is one of a Component_termination_passage_template_interface_terminal (see 5.2.4.289) or a Component_termination_passage_template_join_terminal (see 5.2.4.75).

The data associated with a Component_termination_passage_template_terminal are the following:

— associated_definition;

— name;

— terminal_connection_zone.

4.2.119.1 associated_definition

The associated_definition specifies the role of the Component_termination_passage_template (see 5.2.4.57) for the Component_termination_passage_template_terminal.

4.2.119.2 name

The name specifies the string identifying the Component_termination_passage_template_terminal.

4.2.119.3 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Component_termination_passage_template_terminal. There shall be one or more Connection_zone for a Component_termination_passage_template_terminal.

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Constraints:

UR1: The combination of the associated_definition and the name shall be unique within a population of Component_termination_passage_template_terminals.

WR1: The points comprising the terminal_connection_zones shall be defined in the coordinate system of the device being accessed via the terminal_connection_zones.

4.2.120 Composite_curve

A Composite_curve is a type of Curve (see 4.2.165) that combines more than one Curve into its structure. The Composite_curve shall be continuous.

The data associated with a Composite_curve are the following:

— curve_segment.

4.2.120.1 curve_segment

The curve_segment specifies the role of the Composite_curve_segment (see 5.2.4.379) for the Composite_curve. There shall be one or more Composite_curve_segment for a Composite_curve. No Composite_curve_segment shall be specified more than once as a curve_segment for a particular Composite_curve.

4.2.121 Composite_curve_segment

A Composite_curve_segment is a type of Managed_design_object (see 4.2.431) that is a segment of a Composite_curve (see 5.2.4.112). A Composite_curve_segment associates Curves with a Composite_curve to help compose the Composite_curve.

The data associated with a Composite_curve_segment are the following:

— segment_curve;

— using_curves.

4.2.121.1 segment_curve

The segment_curve specifies the role of the Curve (see 4.2.165) for the Composite_curve_segment.

4.2.121.2 using_curves

The using_curves is an inverse relationship that specifies that the existence of the Composite_curve_segment is dependent on the existence of the Composite_curve (see 5.2.4.112) that specifies the Composite_curve_segment as its curve_segment. There shall be one or more Composite_curve for a Composite_curve_segment.

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4.2.122 Composite_feature_locating_position_tolerance

A Composite_feature_locating_position_tolerance is a type of Position_tolerance_with_referenced_datum_system (see 4.2.559). The Composite_feature_locating_position_tolerance is used in conjunction with one to three Composite_feature_relating_position_tolerance (see 5.2.4.113) to apply a less restrictive specification on the location of a Shape_element (see 4.2.645) group with respect to one or more Datum (see 4.2.176) than on the location and orientation of those Shape_element within the group with respect to each other. The Tolerance_zone (see 4.2.732) defined by the Composite_feature_locating_position_tolerance is located relative to the Datum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

NOTE 1 The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

NOTE 2 Composite positional tolerancing is discussed in 5.4.1 of ASME Y14.5M.

Constraints:

WR1: The Composite_feature_locating_position_tolerance shall not also be a Composite_feature_relating_position_tolerance.

WR2: The Composite_feature_locating_position_tolerance shall be specified as the refined_control by exactly one Composite_feature_relating_position_tolerance.

WR3: The Shape_element that is specified as the toleranced_shape_element shall be a Composite_group_shape_element.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

4.2.123 Composite_feature_relating_position_tolerance

A Composite_feature_relating_position_tolerance is a type of Position_tolerance (see 4.2.558) that is used in conjunction with a Composite_feature_locating_position_tolerance (see 5.2.4.82) and possibly two other Composite_feature_relating_position_tolerance to apply a less restrictive specification on the location of a Shape_element (see 4.2.645) group with respect to one or more Datum (see 4.2.176) than on the location and orientation of those Shape_element within the group with respect to each other. If the Composite_feature_relating_position_tolerance is also a Position_tolerance_with_referenced_datum_system (see 4.2.559), the defined Tolerance_zone (see 4.2.732) is oriented but not located relative to the Datum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

The data associated with a Composite_feature_relating_position_tolerance are the following:

— refined_control.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

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4.2.123.1 refined_control

The refined_control specifies either a Composite_feature_locating_position_tolerance (see 5.2.4.82) or another Composite_feature_relating_position_tolerance to which this Composite_feature_relating_position_tolerance assists in specifying design requirements by specifying a further refinement of the location and orientation of the group of Shape_element (see 4.2.645) in relation to each other.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element by this Composite_feature_relating_position_tolerance shall be the same instance of Shape_element as specified as the toleranced_shape_element by the Position_tolerance that is specified as the refined_control.

WR2: If this Composite_feature_relating_position_tolerance is also a Position_tolerance_without_referenced_datum_system, it shall not be specified as a refined_control by another Composite_feature_relating_position_tolerance.

WR3: If this Composite_feature_relating_position_tolerance specifies a Composite_feature_relating_position_tolerance as the refined_control, this Composite_feature_relating_position_tolerance shall either be a Position_tolerance_without_referenced_datum_system or have less Datum in its Datum_system than the Datum_system of the Composite_feature_relating_position_tolerance specified as the refined_control.

WR4: If this Composite_feature_relating_position_tolerance specifies a Composite_feature_locating_position_tolerance as the refined_control, this Composite_feature_relating_position_tolerance shall either be a Position_tolerance_without_referenced_datum_system or have less than or an equal number of Datum in its Datum_system than the Datum_system of the Composite_feature_locating_position_tolerance specified as the refined_control.

WR5: If this Composite_feature_relating_position_tolerance is a Position_tolerance_with_referenced_datum_system, the Datum in its Datum_system shall be in the Datum_system of the Position_tolerance specified as the refined_control and shall be assigned the same datum precedence.

WR6: If this Composite_feature_relating_position_tolerance specifies a Position_tolerance that specifies a Datum_system_defining_conditions_without_material_conditions as the datum_system_definition, the Position_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_without_material_conditions as its datum_system_definition.

WR7: If this Composite_feature_relating_position_tolerance specifies a Position_tolerance that specifies a Datum_system_defining_conditions_with_material_conditions as the datum_system_definition; the Position_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_with_material_conditions as its datum_system_definition, and each Datum_feature of the Datum_system of this Composite_feature_relating_position_tolerance shall be assigned the same material condition property as is assigned to it in the Datum_system of the Position_tolerance specified as the refined_control.

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WR8: The size of the Tolerance_zone_boundary of this Composite_feature_relating_position_tolerance shall be less than the size of the Tolerance_zone_boundary of the Position_tolerance specified as the refined_control.

WR9: Both the Composite_feature_relating_position_tolerance and the Position_tolerance specified as the refined_control shall specify the same type of Tolerance_zone_definition.

WR10: The Composite_feature_relating_position_tolerance shall be specified as a refined_control by at most one Composite_feature_relating_position_tolerance.

WR11: Both the Composite_feature_relating_position_tolerance and the Position_tolerance specified as the refined_control shall specify the same type of Tolerance_zone_boundary_definition.

WR12: Both the Composite_feature_relating_position_tolerance and the Position_tolerance specified as the refined_control shall specify the same type of Boundary_size_characteristic.

4.2.124 Composite_group_shape_element

A Composite_group_shape_element is a type of Composite_shape_element (see 5.2.4.125) in which the composite may be thought of as a group of individual Shape_element (see 4.2.645) in which any property that is applied to the Composite_group_shape_element is applied to each of the constituent Shape_elements on an individual basis.

EXAMPLE 1 A group of cylindrical holes in a printed circuit board may be grouped with a Composite_group_-shape_element for the purpose of applying the same Cylindricity_tolerance to each of the constituent holes in the group.

Constraints:

WR1: If all the Shape_elements that compose the Composite_group_shape_element are of the same type then the Composite_shape_element shall also be of that type.

EXAMPLE 2 If all the Shape_elements that compose a Composite_group_shape_element are of type Centre_-axis then, the Composite_group_shape_element will also be of type Centre_axis.

4.2.125 Composite_linear_profile_locating_tolerance

A Composite_linear_profile_locating_tolerance is a type of Profile_of_any_line_tolerance_with_refer-enced_datum_system (see 5.2.4.156). The Composite_linear_profile_locating_tolerance is used in con-junction with one to three Composite_linear_profile_refinement_tolerance (see 5.2.4.40) to apply a more restrictive specification on the form, orientation, and possibly size of a Physical_feature_or_part_tem-plate (see 4.2.527) than on the location of the Physical_feature_or_part_template. The Tolerance_zone (see 4.2.732) defined by the Composite_linear_profile_locating_tolerance is located relative to the Da-tum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system entity of which this entity is a subtype.

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Constraints:

WR1: The Composite_linear_profile_locating_tolerance shall not also be a Composite_linear_profile_-refinement_tolerance.

WR2: The Composite_linear_profile_locating_tolerance shall be specified as the refined_control by exactly one Composite_linear_profile_refinement_tolerance.

4.2.126 Composite_linear_profile_refinement_tolerance

A Composite_linear_profile_refinement_tolerance is a type of Profile_of_any_line_tolerance (see 5.2.4.41) that is used in conjunction with a Composite_linear_profile_locating_tolerance (see 5.2.4.155) and possibly two other Composite_linear_profile_refinement_tolerance to apply a more restrictive specification on the form, orientation, and possibly size of a Physical_feature_or_part_template (see 4.2.527) than on the location of the Physical_feature_or_part_template. If the Composite_linear_profile_refinement_tolerance is also a Profile_of_any_line_tolerance_with_referenced_datum_system (see 5.2.4.156) the defined Tolerance_zone (see 4.2.732) is oriented but not located relative to the Datum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system (see 4.2.357) entity of which this entity is a subtype.

The data associated with a Composite_linear_profile_refinement_tolerance are the following:

— refined_control.

4.2.126.1 refined_control

The refined_control specifies either a Composite_linear_profile_locating_tolerance (see 5.2.4.155) or another Composite_linear_profile_refinement_tolerance to which this Composite_linear_profile_refinement_tolerance assists in specifying design requirements by specifying a further refinement of the form, orientation, and possibly size of the Physical_feature_or_part_template (see 4.2.527) specified as the toleranced_shape_element.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

Constraints:

WR1: The Physical_feature_or_part_template specified as the toleranced_shape_element by this Composite_linear_profile_refinement_tolerance shall be the same instance of Physical_feature_or_part_template as specified as the toleranced_shape_element by the Profile_of_any_line_tolerance that is specified as the refined_control.

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WR2: If this Composite_linear_profile_refinement_tolerance is also a Profile_of_any_line_tolerance_-without_referenced_datum_system, it shall not be specified as a refined_control by another Composite_-linear_profile_refinement_tolerance.

WR3: If this Composite_linear_profile_refinement_tolerance specifies a Composite_linear_profile_refinement_tolerance as the refined_control, this Composite_linear_profile_refinement_tolerance shall either be a Profile_of_any_line_tolerance_without_referenced_datum_system or have less Datum in its Datum_system than the Datum_system of the Composite_linear_profile_refinement_tolerance specified as the refined_control.

WR4: If this Composite_linear_profile_refinement_tolerance specifies a Composite_linear_profile_locating_tolerance as the refined_control, this Composite_linear_profile_refinement_tolerance shall either be a Profile_of_any_line_tolerance_without_referenced_datum_system or have less than or an equal number of Datum in its Datum_system than the Datum_system of the Composite_linear_profile_locating_tolerance specified as the refined_control.

WR5: If this Composite_linear_profile_refinement_tolerance is a Profile_of_any_line_tolerance_with_-referenced_datum_system, the Datum in its Datum_system shall be in the Datum_system of the Profile_-of_any_line_tolerance specified as the refined_control and shall be assigned the same datum precedence.

WR6: If this Composite_linear_profile_refinement_tolerance specifies a Profile_of_any_line_tolerance that specifies a Datum_system_defining_conditions_without_material_conditions as the datum_system_-definition, the Profile_of_any_line_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_without_material_conditions as its datum_system_definition.

WR7: If this Composite_linear_profile_refinement_tolerance specifies a Profile_of_any_line_tolerance that specifies a Datum_system_defining_conditions_with_material_conditions as the datum_system_-definition; the Profile_of_any_line_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_with_material_conditions as its datum_system_definition, and each Datum_feature of the Datum_system of this Composite_linear_profile_refinement_tolerance shall be assigned the same material condition property as is assigned to it in the Datum_system of the Profile_of_-any_line_tolerance specified as the refined_control.

WR8: The size of the Tolerance_zone_boundary of this Composite_linear_profile_refinement_tolerance shall be less than the size of the Tolerance_zone_boundary of the Profile_of_any_line_tolerance specified as the refined_control.

WR9: The Tolerance_zone_boundary of this Composite_linear_profile_refinement_tolerance shall be based on the same True_profile as the Tolerance_zone_boundary of the Profile_of_any_line_tolerance specified as the refined_control.

WR10: The Composite_linear_profile_refinement_tolerance shall be specified as a refined_control by at most one Composite_linear_profile_refinement_tolerance.

WR11: If the Tolerance_zone_definition that is specified as the tolerance_zone_or_boundary_definition is a Tolerance_zone_definition_with_specified_orientation, the Tolerance_zone_definition that is specified as the tolerance_zone_or_boundary_definition by the Profile_of_any_line_tolerance that is specified as the refined_control shall also be a Tolerance_zone_definition_with_specified_orientation, and the orientations shall be the same.

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4.2.127 Composite_shape_element

Composite_shape_element is a type of Shape_element (see 4.2.645) that is composed of two or more constituent Shape_elements. A Composite_shape_element is either a Composite_group_shape_element (see 5.2.4.114) or a Composite_unit_shape_element (see 5.2.4.63).

The data associated with a Composite_shape_element are the following:

— composing_relationships.

4.2.127.1 composing_relationships

The composing_relationships is an inverse relationship that specifies that the existence of the Composite_shape_element is dependent on the existence of the Shape_element_composing_relationship (see 5.2.4.242) that specifies the Composite_shape_element as its relating_shape_element. There shall be two or more Shape_element_composing_relationship for a Composite_shape_element.

4.2.128 Composite_signal_property

A Composite_signal_property is a type of Signal_property (see 5.2.4.150) that combines more than one signal property into its structure. This part of ISO 10303 does not predefine the domain semantics of the structural relationship.

The data associated with a Composite_signal_property are the following:

— signal_property_structure.

4.2.128.1 signal_property_structure

The signal_property_structure is an inverse relationship that specifies that the existence of the Composite_signal_property is dependent on the existence of the Composite_signal_property_relationship (see 5.2.4.151) that specifies the Composite_signal_property as its composition. There shall be one or more Composite_signal_property_relationship for a Composite_signal_property.

4.2.129 Composite_signal_property_relationship

A Composite_signal_property_relationship is a type of Managed_design_object (see 4.2.431). A Composite_signal_property_relationship is the aggregation of the Signal_property (see 5.2.4.150) that compose the Composite_signal_property (see 5.2.4.243).

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The data associated with a Composite_signal_property_relationship are the following:

— aggregation_operation;

— composition;

— signal_property_structural_element.

4.2.129.1 aggregation_operation

The aggregation_operation specifies the External_definition (see 4.2.304) for the mathematical model for the inclusion of an element in the Composite_signal_property_relationship. The structure that the aggregation_operation helps to implement shall be specified by an ISO or an IEC standard.

4.2.129.2 composition

The composition specifies the role of the Composite_signal_property (see 5.2.4.243) for the Composite_signal_property_relationship. The structure shall be defined by an ISO or IEC standard.

4.2.129.3 signal_property_structural_element

The signal_property_structural_element specifies the Signal_property (see 5.2.4.150) that is being included in the Composite_signal_property_relationship.

NOTE Signal property composition may be domain specific and is covered by available standards.

4.2.130 Composite_surface_profile_locating_tolerance

A Composite_surface_profile_locating_tolerance is a type of Profile_of_any_surface_tolerance_with_referenced_datum_system (see 4.2.597). The Composite_surface_profile_locating_tolerance is used in conjunction with one to three Composite_surface_profile_refinement_tolerance (see 5.2.4.334) to apply a more restrictive specification on the form, orientation, and possibly size of a Physical_feature_or_part_template (see 4.2.527) than on the location of the Physical_feature_or_part_template. The Tolerance_zone (see 4.2.732) defined by the Composite_surface_profile_locating_tolerance is located relative to the Datum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

NOTE 1 The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

NOTE 2 Composite profile tolerancing is discussed in 6.5.9.1 of ASME Y14.5M.

Constraints:

WR1: The Composite_surface_profile_locating_tolerance shall not also be a Composite_surface_profile_refinement_tolerance.

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WR2: The Composite_surface_profile_locating_tolerance shall be specified as the refined_control by exactly one Composite_surface_profile_refinement_tolerance.

4.2.131 Composite_surface_profile_refinement_tolerance

A Composite_surface_profile_refinement_tolerance is a type of Profile_of_any_surface_tolerance (see 4.2.596) that is used in conjunction with a Composite_surface_profile_locating_tolerance (see 5.2.4.333) and possibly two other Composite_surface_profile_refinement_tolerance to apply a more restrictive specification on the form, orientation, and possibly size of a Physical_feature_or_part_template (see 4.2.527) than on the location of the Physical_feature_or_part_template. If the Composite_surface_profile_refinement_tolerance is also a Profile_of_any_surface_tolerance_with_referenced_datum_system (see 4.2.597) the defined Tolerance_zone (see 4.2.732) is oriented but not located relative to the Datum_system (see 5.2.4.316) the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system (see 4.2.357) entity of which this entity is a subtype.

The data associated with a Composite_surface_profile_refinement_tolerance are the following:

— refined_control.

4.2.131.1 refined_control

The refined_control specifies either a Composite_surface_profile_locating_tolerance (see 5.2.4.333) or another Composite_surface_profile_refinement_tolerance to which this Composite_surface_profile_refinement_tolerance assists in specifying design requirements by specifying a further refinement of the form, orientation, and possibly size of the Physical_feature_or_part_template (see 4.2.527) specified as the toleranced_shape_element.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

Constraints:

WR1: The Physical_feature_or_part_template specified as the toleranced_shape_element by this Composite_surface_profile_refinement_tolerance shall be the same instance of Physical_feature_or_part_template as specified as the toleranced_shape_element by the Profile_of_any_surface_tolerance that is specified as the refined_control.

WR2: If this Composite_surface_profile_refinement_tolerance is also a Profile_of_any_surface_tolerance_without_referenced_datum_system, it shall not be specified as a refined_control by another Composite_surface_profile_refinement_tolerance.

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WR3: If this Composite_surface_profile_refinement_tolerance specifies a Composite_surface_profile_-refinement_tolerance as the refined_control, this Composite_surface_profile_refinement_tolerance shall either be a Profile_of_any_surface_tolerance_without_referenced_datum_system or have less Datum in its Datum_system than the Datum_system of the Composite_surface_profile_refinement_tolerance specified as the refined_control.

WR4: If this Composite_surface_profile_refinement_tolerance specifies a Composite_surface_profile_-locating_tolerance as the refined_control, this Composite_surface_profile_refinement_tolerance shall either be a Profile_of_any_surface_tolerance_without_referenced_datum_system or have less than or an equal number of Datum in its Datum_system than the Datum_system of the Composite_surface_profile_locating_tolerance specified as the refined_control.

WR5: If this Composite_surface_profile_refinement_tolerance is a Profile_of_any_surface_tolerance_-with_referenced_datum_system, the Datum in its Datum_system shall be in the Datum_system of the Profile_of_any_surface_tolerance specified as the refined_control and shall be assigned the same datum precedence.

WR6: If this Composite_surface_profile_refinement_tolerance specifies a Profile_of_any_surface_tolerance that specifies a Datum_system_defining_conditions_without_material_conditions as the datum_-system_definition, the Profile_of_any_surface_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_without_material_conditions as its datum_system_definition.

WR7: If this Composite_surface_profile_refinement_tolerance specifies a Profile_of_any_surface_tolerance that specifies a Datum_system_defining_conditions_with_material_conditions as the datum_system_definition; the Profile_of_any_surface_tolerance specified as the refined_control shall also specify a Datum_system_defining_conditions_with_material_conditions as its datum_system_definition, and each Datum_feature of the Datum_system of this Composite_surface_profile_refinement_tolerance shall be assigned the same material condition property as is assigned to it in the Datum_system of the Profile_-of_any_surface_tolerance specified as the refined_control.

WR8: The size of the Tolerance_zone_boundary of this Composite_surface_profile_refinement_tolerance shall be less than the size of the Tolerance_zone_boundary of the Profile_of_any_surface_tolerance specified as the refined_control.

WR9: The Tolerance_zone_boundary of this Composite_surface_profile_refinement_tolerance shall be based on the same True_profile as the Tolerance_zone_boundary of the Profile_of_any_surface_tolerance specified as the refined_control.

WR10: The Composite_surface_profile_refinement_tolerance shall be specified as a refined_control by at most one Composite_surface_profile_refinement_tolerance.

4.2.132 Composite_unit_shape_element

A Composite_unit_shape_element is a type of Composite_shape_element (see 5.2.4.125) that is treated as a unit, as opposed to as a group of individual Shape_element (see 4.2.645).

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EXAMPLE 1 A Profile_of_any_surface_tolerance (see 4.2.596) is applied to a square cut-out that goes through a printed circuit board. The square cut-out is a Composite_unit_shape_element that consists of the four constituent Shape_elements that correspond to the four surfaces of the cut-out.

EXAMPLE 2 A Flatness_tolerance (see 5.2.4.364) may be applied to a Composite_unit_shape_element to specify that the coplanar surfaces that make up the Composite_unit_shape_element are required to fall within a common Tolerance_zone (see 4.2.732).

NOTE Common tolerance zones are described in 7.5 of ISO 1101.

4.2.133 Concentricity_and_coaxiality_tolerance

A Concentricity_and_coaxiality_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on either the concentricity or the coaxiality of the toleranced Shape_element (see 4.2.645) in relation to a Datum (see 4.2.176). Coaxiality is the quality or state of being coaxial.

NOTE Concentricity and coaxiality tolerance is defined in terms of tolerance zone definitions in 14.11 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be either a Centre_axis or a Centre_point.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: There shall be exactly one Datum in the Datum_system the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

WR3: If the Shape_element specified as the toleranced_shape_element is a Centre_point, the Datum of the Datum_system the definition of which is specified as the datum_system_definition shall be a Datum_point.

WR4: If the Shape_element specified as the toleranced_shape_element is a Centre_axis, the Datum of the Datum_system the definition of which is specified as the datum_system_definition shall be a Datum_axis.

WR5: The Concentricity_and_coaxiality_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify a Diametrical_boundary_size_characteristic as its specified_boundary_size.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a concentricity and coaxiality tolerance is sensible.

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4.2.134 Conductive_filled_area

A Conductive_filled_area is a type of Stratum_feature (see 4.2.683) in which the material is conductive. A Conductive_filled_area may be a Connected_filled_area (see 5.2.4.153).

4.2.135 Conductive_interconnect_element

A Conductive_interconnect_element is a type of Laminate_component (see 4.2.404). A Conductive_interconnect_element is either a Conductive_interconnect_element_with_pre_defined_transitions (see 5.2.4.419) or a Conductive_interconnect_element_with_user_defined_single_transition (see 4.2.138). A Conductive_interconnect_element specifies one portion of a Stratum_feature (see 4.2.683) that has a sequential arrangement of Layer_connection_point (see 5.2.4.420).

NOTE A domain term for a Conductive_interconnect_element is a trace. The domain term may include additional aspects over that defined in this application object in certain cases. For that reason, this part of ISO 10303 does not attempt to prescribe or limit the application of the term trace by standardizing it.

EXAMPLE 1 An example of multiple Conductive_interconnect_element, Land (see 4.2.407), and Stratum_feature_template_component (see 5.2.4.161) that contribute to the definition of a Conductor (see 5.2.4.162) are shown in the partially exploded view of a Conductor in figure 5.2.4.163.

The data associated with a Conductive_interconnect_element are the following:

— access_mechanisms;

— composed_conductor.

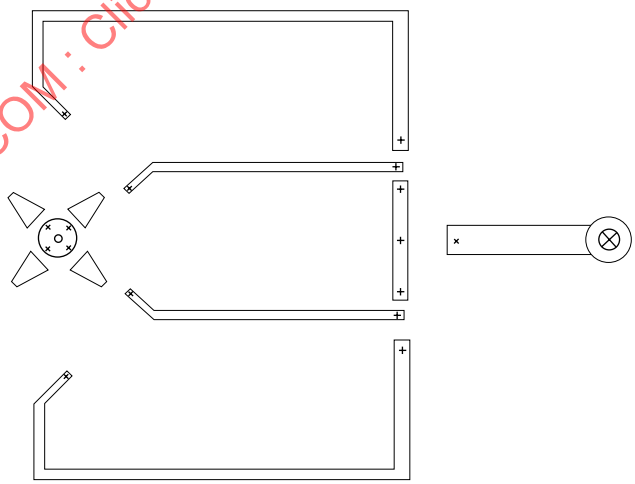

Figure 18 – Partially exploded view of a Conductor

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4.2.135.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Conductive_interconnect_element is dependent on the existence of the Conductive_interconnect_element_terminal (see 5.2.4.11) that specifies the Conductive_interconnect_element as its associated_component. There shall be two Conductive_interconnect_element_terminals for a Conductive_interconnect_element.

4.2.135.2 composed_conductor

The composed_conductor specifies the role of the Stratum_feature (see 4.2.683) for the Conductive_interconnect_element.

Constraints:

WR1: The members of Layer_connection_point specified by a member of Conductive_interconnect_element shall also be specified by the feature this interconnect_element is composing. This is a non-exclusive rule. Other members of Layer_connection_point may be specified by the conductor.

4.2.136 Conductive_interconnect_element_terminal

A Conductive_interconnect_element_terminal is a type of Component_terminal (see 4.2.105). The Conductive_interconnect_element_terminal is a terminal for the trace defined by Conductive_interconnect_element.

NOTE This is used for detailed design and analysis, and also as a means to check the quality of geometry representation and transfer.

The data associated with a Conductive_interconnect_element_terminal are the following:

— associated_component;

— connection;

— name.

4.2.136.1 associated_component

The associated_component specifies the role of the Conductive_interconnect_element (see 5.2.4.154) for the Conductive_interconnect_element_terminal.

4.2.136.2 connection

The connection specifies the role of the Connection_zone (see 4.2.147) for the Conductive_interconnect_element_terminal.

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4.2.136.3 name

The name specifies the string for the human-interpretable identifier for the Conductive_interconnect_-element_terminal.

Constraints:

UR1: The combination of name and associated_component inherited from Component_feature shall be unique within a population of Conductive_interconnect_element_terminal.

4.2.137 Conductive_interconnect_element_with_pre_defined_transitions

A Conductive_interconnect_element_with_pre_defined_transitions is a type of Conductive_interconnect_-element (see 5.2.4.154). The data provided by Conductive_interconnect_element_with_pre_defined_-transitions is typical data available from two dimensional CAD applications. The data does not include explicit representation of the variability in the vertical dimension that occurs in a real "planar" product due to material build up of successive layers of material. The usage_definition is required to be orthogonal to the centreline_shape_representation, but this is insufficient information in a three-dimensional layout. In a two-dimensional layout, the usage_definition shape x direction vector is constrained to be parallel with the x direction vector of the shape of the Stratum_feature (see 4.2.683) referenced by the inherited attribute composed_conductor. In a two-dimensional design, all Stratum_features are parallel. In a three-dimensional design, the same parallelism constraint applies, but the underlying substrate is not presumed to be planar. The underlying surface shape idealization is contained in the Stratum_-surface_shape (see 5.2.4.115) or Stratum_average_surface_shape (see 5.2.4.380). The Stratum_feature_-shape_stratum_surface_shape_relationship (see 5.2.4.308) or Stratum_feature_shape_stratum_average_-surface_shape_relationship (see 5.2.4.309)shall be populated to specify to a processor the design intent. The centreline_shape_representation shall be a subset of either the points in the Stratum_average_surface_shape or of the points in the Stratum_surface_shape.

NOTE The "pre-defined transition" refers to the extrusion of the trace_template shape (a cross-sectional definition) along the path defined by its centreline_shape_representation (a Curve (see 4.2.165)).

The data associated with a Conductive_interconnect_element_with_pre_defined_transitions are the following:

— centreline_shape_representation;

— connected_point;

— usage_definition.

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4.2.137.1 centreline_shape_representation

The centreline_shape_representation specifies the Curve representing the centreline of the Conductive_interconnect_element_with_pre_defined_transitions. The centreline when combined with the usage_definition provides a CAD abstraction of the physical shape.

4.2.137.2 connected_point

The connected_point specifies the role of the Layer_connection_point_link (see 5.2.4.381) for the Conductive_interconnect_element. There shall be one or more Layer_connection_point_link for a Conductive_interconnect_element. No Layer_connection_point_link shall be specified more than once as a connected_point for a Conductive_interconnect_element.

4.2.137.3 usage_definition

The usage_definition specifies the role of the Trace_template (see 5.2.4.29) for the Conductive_interconnect_element_with_pre_defined_transitions. The usage_definition is a cross section definition. When combined with the centreline shape, a complete CAD abstraction is formed for the two-dimensional case. The three-dimensional case requires additional data representing the abstract surface in which the conductor being defined will be located.

NOTE The Trace_template describes the cross-section parameters required by a processor that adds material along the path described by the centreline.

4.2.138 Conductive_interconnect_element_with_user_defined_single_transition

A Conductive_interconnect_element_with_user_defined_single_transition is a type of Conductive_interconnect_element (see 5.2.4.154). The Conductive_interconnect_element_with_user_defined_single_transition supports the specification of custom start and end shape templates and separately specified left_curve_shape_representation and right_curve_shape_representation (which are either Bounding_curve or Trimmed_line).

NOTE 1 For examples of the curves that can be used, see Bounding_curve (see 4.2.62).

NOTE 2 The electrical properties of the Conductive_interconnect_element_with_user_defined_single_transition may be assigned using a requirement allocation structure.

EXAMPLE 1 Figure 12 illustrates a detail of a layout drawing that shows a transition on a trace. The segment "l" is supported in this part of ISO 10303 as a member of Conductive_interconnect_element_with_user_defined_single_transition.

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The data associated with a Conductive_interconnect_element_with_user_defined_single_transition are the following:

— end_definition;

— end_terminus ;

— left_curve_shape_representation ;

— right_curve_shape_representation ;

— start_definition ;

— start_terminus .

4.2.138.1 end_definition

The end_definition specifies one role of the Trace_template (see 5.2.4.29) for the Conductive_interconnect_element_with_user_defined_single_transition.

4.2.138.2 end_terminus

The end_terminus specifies one role of the Layer_connection_point (see 5.2.4.420) for the Conductive_interconnect_element_with_user_defined_single_transition.

4.2.138.3 left_curve_shape_representation

The left_curve_shape_representation specifies one role of either a Bounding_curve (see 4.2.62) or Trimmed_line (see 4.2.752) for the Conductive_interconnect_element_with_user_defined_single_transition.

4.2.138.4 right_curve_shape_representation

The right_curve_shape_representation specifies one role of either a Bounding_curve (see 4.2.62) or Trimmed_line (see 4.2.752) for the Conductive_interconnect_element_with_user_defined_single_transition.

4.2.138.5 start_definition

The start_definition specifies one role of the Trace_template (see 5.2.4.29) for the Conductive_interconnect_element_with_user_defined_single_transition.

4.2.138.6 start_terminus

The start_terminus specifies one role of the Layer_connection_point (see 5.2.4.420) for the Conductive_interconnect_element_with_user_defined_single_transition.

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4.2.139 Conductor

A Conductor is a type of Stratum_feature (see 4.2.683) realized in a Design_layer_stratum (see 5.2.4.382) that participates in the implementation of a Physical_network (see 5.2.4.17).

EXAMPLE 1 Figure 5.2.4.236 illustrates a detail of a layout drawing that shows the Conductor in relationship to a component at the next level of the assembly.

The data associated with a Conductor are the following:

— implementation_requirement.

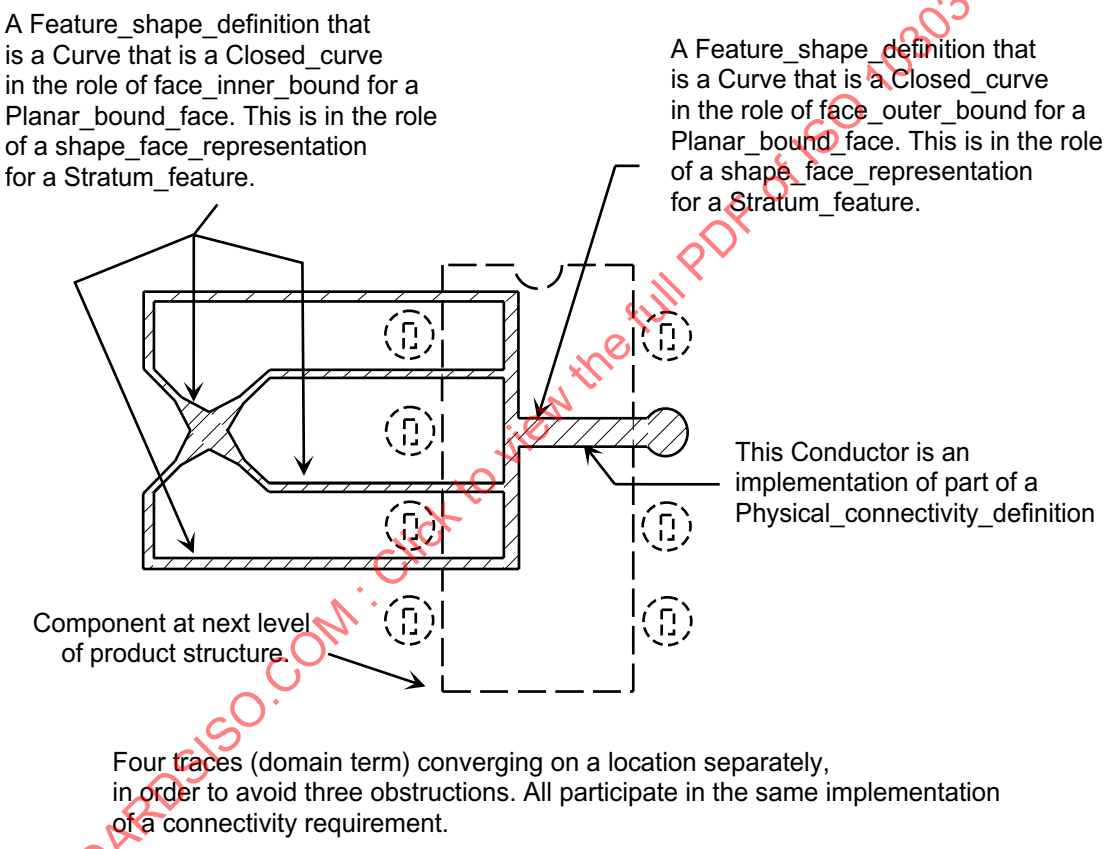

Figure 19 – Conductor

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4.2.139.1 implementation_requirement

The implementation_requirement specifies the Intra_stratum_join_relationship (see 5.2.4.354) that is used to constrain the Conductor by specifying the Layer_connection_point (see 5.2.4.420) that are to be connected by the Conductor.

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Constraints:

WR1: The shape that is a Stratum_feature shape shall not violate the nearest approach constraint to another shape assigned to the same design layer and realized as the stratum material of the design layer stratum.

WR2: A Conductor shall enclose two or more layer connection point in the region between or on the outer bound and an inner bound; or inside or on the outer bound that has no inner bound.

4.2.140 Configuration_controlled_message

A Configuration_controlled_message is a type of Managed_design_object (see 4.2.431). A Configuration_controlled_message is a message that has its content under version control, and that is source data for application of marking materials to a product.

The data associated with a Configuration_controlled_message are the following:

— message_content;

— message_source;

— message_type_specification.

4.2.140.1 message_content

The message_content specifies the text in the Configuration_controlled_message.

4.2.140.2 message_source

The message_source specifies either an Ee_approval (see 4.2.269), an Ee_product_version (see 4.2.282), or an Organization (see 5.2.4.135) for the Configuration_controlled_message.

4.2.140.3 message_type_specification

The message_type_specification specifies either an approval_date, a manufacturer_code, a part_number, or a revision_identifier for the Configuration_controlled_message. A message_type_specification is necessary to differentiate among the possible message sources to identify the one that has been selected for the literal string.

Constraints:

WR1: If message_type_specification is "approval_date" then message_content is equal to Ee_approval.signoff_date.

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WR2: If message_type_specification is "manufacturer_code" then message_content is equal to Organization.identifier.

WR3: If message_type_specification is "part_number" then message_content is equal to Ee_product.part_number.

WR4: If message_type_specification is "revision_code" then message_content is equal to Ee_product_version.revision_code.

4.2.141 Conical_tolerance_zone_boundary

A Conical_tolerance_zone_boundary is a type of Tolerance_zone_boundary (see 4.2.734) that is conical in form. The shape of the Conical_tolerance_zone_boundary is defined by a frustum, the size of which is specified at the surfaces that define the ends of the frustum.

The data associated with a Conical_tolerance_zone_boundary are the following:

— boundary_and_surface_relationships.

4.2.141.1 boundary_and_surface_relationships

The boundary_and_surface_relationships is an inverse relationship that specifies that the existence of the Conical_tolerance_zone_boundary is dependent on the existence of two Conical_tolerance_zone_boundary_and_surface_relationship (see 5.2.4.141) that specify the Conical_tolerance_zone_boundary as their sized_tolerance_zone_boundary. There shall be exactly two Conical_tolerance_zone_boundary_and_surface_relationship for a Conical_tolerance_zone_boundary.

4.2.142 Conical_tolerance_zone_boundary_and_surface_relationship

A Conical_tolerance_zone_boundary_and_surface_relationship is a type of Managed_design_object (see 4.2.431). A Conical_tolerance_zone_boundary_and_surface_relationship is a relationship that associates a Conical_tolerance_zone_boundary (see 5.2.4.140) with one of the two Physical_feature_or_part_template (see 4.2.527) at which the Conical_tolerance_zone_boundary diameter is specified.

The data associated with a Conical_tolerance_zone_boundary_and_surface_relationship are the following:

— size_characteristic;

— sized_tolerance_zone_boundary;

— terminating_surface.

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4.2.142.1 size_characteristic

The size_characteristic is an inverse relationship that specifies that the existence of the Conical_tolerance_zone_boundary_and_surface_relationship is dependent on the existence of the Conical_tolerance_zone_boundary_diametrical_size_characteristic (see 5.2.4.346) that specifies the Conical_tolerance_zone_boundary_and_surface_relationship as its sized_boundary_at_surface.

4.2.142.2 sized_tolerance_zone_boundary

The sized_tolerance_zone_boundary specifies the Conical_tolerance_zone_boundary (see 5.2.4.140) the diameter of which is specified at the Physical_feature_or_part_template (see 4.2.527) specified as the terminating_surface.

4.2.142.3 terminating_surface

The terminating_surface specifies the Physical_feature_or_part_template (see 4.2.527) at which the diameter is specified for the Conical_tolerance_zone_boundary (see 5.2.4.140).

4.2.143 Conical_tolerance_zone_boundary_definition

A Conical_tolerance_zone_boundary_definition is a type of Tolerance_zone_boundary_definition (see 4.2.735) that characterizes a Conical_tolerance_zone_boundary (see 5.2.4.140).

The data associated with a Conical_tolerance_zone_boundary_definition are the following:

— boundary_sizes;

— defined_zone_boundary.

4.2.143.1 boundary_sizes

The boundary_sizes specifies the Conical_tolerance_zone_boundary_diametrical_size_characteristic (see 5.2.4.346) that defines the size of the Conical_tolerance_zone_boundary (see 5.2.4.140) at specified Physical_feature_or_part_templates. There shall be exactly two Conical_tolerance_zone_boundary_diametrical_size_characteristic specified as the boundary_sizes for the Conical_tolerance_zone_boundary_definition.

4.2.143.2 defined_zone_boundary

The defined_zone_boundary specifies the Conical_tolerance_zone_boundary (see 5.2.4.140) that is characterized by the Conical_tolerance_zone_boundary_definition.

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Constraints:

WR1: Each Geometric_tolerance that defines a Conical_tolerance_zone_boundary_diametrical_size_-characteristic of the Conical_tolerance_zone_boundary_definition shall be of the same type.

WR2: Each Geometric_tolerance that defines a Conical_tolerance_zone_boundary_diametrical_size_-characteristic of the Conical_tolerance_zone_boundary_definition shall reference the same Datum_system_defining_conditions.

WR3: Each Geometric_tolerance that defines a Conical_tolerance_zone_boundary_diametrical_size_-characteristic of the Conical_tolerance_zone_boundary_definition shall specify the same value for the applied_material_condition_property_name.

WR4: Each Geometric_tolerance that defines a Conical_tolerance_zone_boundary_diametrical_size_-characteristic of the Conical_tolerance_zone_boundary_definition shall specify the same instance of Centre_axis as the toleranced_shape_element.

WR5: The Conical_tolerance_zone_boundary_definition shall be specified as the boundary_definition by a Conical_tolerance_zone_definition.

4.2.144 Conical_tolerance_zone_boundary_diametrical_size_characteristic

A Conical_tolerance_zone_boundary_diametrical_size_characteristic is a type of Managed_design_object (see 4.2.431). A Conical_tolerance_zone_boundary_diametrical_size_characteristic is a definition that characterizes the size of a Conical_tolerance_zone_boundary (see 5.2.4.140) at one of the Physical_-feature_or_part_template (see 4.2.527) that defines the ends of the Conical_tolerance_zone_boundary.

The data associated with a Conical_tolerance_zone_boundary_diametrical_size_characteristic are the following:

— boundary_definition;

— sized_boundary_at_surface;

— tolerance_value.

4.2.144.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Conical_tolerance_zone_boundary_diametrical_size_characteristic is dependent on the existence of the Conical_tolerance_zone_boundary_definition (see 5.2.4.347) that specifies the Conical_tolerance_zone_boundary_-diametrical_size_characteristic as one of its boundary_sizes.

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4.2.144.2 sized_boundary_at_surface

The sized_boundary_at_surface specifies the Conical_tolerance_zone_boundary_and_surface_relationship (see 5.2.4.141) that associates the Conical_tolerance_zone_boundary (see 5.2.4.140) with a Physical_feature_or_part_template (see 4.2.527) that defines an end of the Conical_tolerance_zone_boundary at which the size is characterized by the Conical_tolerance_zone_boundary_diametrical_size_characteristic.

4.2.144.3 tolerance_value

The tolerance_value specifies the Length_data_element (see 4.2.422) that represents the diameter of the specified Conical_tolerance_zone_boundary (see 5.2.4.140) at the specified Physical_feature_or_part_template (see 4.2.527) for the Conical_tolerance_zone_boundary_diametrical_size_characteristic.

Constraints:

WR1: The Conical_tolerance_zone_boundary specified as the sized_tolerance_zone_boundary by the Conical_tolerance_zone_boundary_and_surface_relationship that is specified as the sized_boundary_at_surface shall be the same instance of Conical_tolerance_zone_boundary as specified as the defined_zone_boundary by the Conical_tolerance_zone_boundary_definition that is specified as the boundary_definition. That is, the Conical_tolerance_zone_boundary_diametrical_size_characteristic and the Conical_tolerance_zone_boundary_definition specified as the boundary_definition shall define the same Conical_tolerance_zone_boundary.

WR2: The Conical_tolerance_zone_boundary_diametrical_size_characteristic shall be specified by exactly one Geometric_tolerance as the tolerance_zone_or_boundary_definition, and that Geometric_tolerance shall be one of a Position_tolerance, a Parallelism_tolerance, a Perpendicularity_tolerance, or an Angularity_tolerance.

4.2.145 Conical_tolerance_zone_definition

A Conical_tolerance_zone_definition is a type of Tolerance_zone_definition (see 4.2.739) the boundary of which is defined by a Conical_tolerance_zone_boundary_definition (see 5.2.4.347). A Conical_tolerance_zone_definition is defined when it is desired to place a more restrictive specification on one end of a Shape_element (see 4.2.645) than on the other end.

NOTE Conical tolerance zones are described in 5.8 of ASME Y14.5M.

The data associated with a Conical_tolerance_zone_definition are the following:

— boundary_definition.

4.2.145.1 boundary_definition

The boundary_definition specifies the Conical_tolerance_zone_boundary_definition (see 5.2.4.347) that defines the boundary for the Conical_tolerance_zone_definition.

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Constraints:

WR1: The Conical_tolerance_zone_definition shall not be specified as the tolerance_zone_or_boundary_definition by a Geometric_tolerance.

4.2.146 Connected_filled_area

A Connected_filled_area is a type of Conductive_filled_area (see 5.2.4.365). The Connected_filled_area is a Conductive_filled_area (see 5.2.4.365) with which a set of layer connection points are associated (as specified in the implementation_requirement attribute).

The data associated with a Connected_filled_area are the following:

— implementation_requirement.

4.2.146.1 implementation_requirement

The implementation_requirement specifies the Intra_stratum_join_relationship (see 5.2.4.354) for which the Connected_filled_area is generated.

4.2.147 Connection_zone

A Connection_zone is a type of Managed_design_object (see 4.2.431). A Connection_zone is an area on the surface of a design object that may be used to establish electrical connectivity with another design object.

The data associated with a Connection_zone are the following:

— zone_shape;

— representation_colour.

4.2.147.1 zone_shape

The zone_shape specifies the Feature_shape_occurrence (see 4.2.316) that defines the Connection_zone. There shall be one or more zone_shape for a Connection_zone.

4.2.147.2 representation_colour

The representation_colour specifies the Ee_colour (see 5.2.4.353) that depicts the area constituting the Connection_zone.

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Constraints:

WR1: All points in a Connection_zone shall be topologically connected.

WR2: A particular instance of Connection_zone shall not be referenced by more than one feature within the same Physical_unit_usage_view.

4.2.148 Connection_zone_based_assembly_joint

A Connection_zone_based_assembly_joint is a type of Assembly_joint (see 4.2.32). A Connection_zone_based_assembly_joint consists of a zone_1 and a zone_2.

The data associated with a Connection_zone_based_assembly_joint are the following:

— zone_1;

— zone_2.

4.2.148.1 zone_1

A zone_1 specifies one role of a Connection_zone (see 4.2.147) for a Connection_zone_based_assembly_joint.

4.2.148.2 zone_2

A zone_2 specifies one role of a Connection_zone (see 4.2.147) for a Connection_zone_based_assembly_joint.

NOTE There are no semantics associated with the sequence of zones in a Connection_zone_based_assembly_joint.

Constraints:

WR1: The zone_1 shall not be zone_2.

4.2.149 Connection_zone_interface_plane_relationship

A Connection_zone_interface_plane_relationship is a type of Managed_design_object (see 4.2.431). A Connection_zone_interface_plane_relationship establishes a product structure relationship that may be represented in a geometric context for the purpose of deriving a 2D or 3D representation of the intersection of a terminal interface.

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The data associated with a Connection_zone_interface_plane_relationship are the following:

— interface_plane;

— mating_zone;

— name.

4.2.149.1 interface_plane

An interface_plane specifies the role of a Seating_plane (see 4.2.640) for the Connection_zone_interface_plane_relationship.

4.2.149.2 mating_zone

A mating_zone specifies the role of a Connection_zone (see 4.2.147)for the Connection_zone_interface_plane_relationship.

4.2.149.3 name

A name specifies the string that identifies the Connection_zone_interface_plane_relationship.

Constraints:

UR1: The name shall be unique within a population of Connection_zone_interface_plane_relationship.

4.2.150 Connection_zone_model_port_assignment

A Connection_zone_model_port_assignment is a type of Managed_design_object (see 4.2.431). A Connection_zone_model_port_assignment is the relationship between the Analytical_model_port (see 4.2.11) and the Connection_zone (see 4.2.147), for the purpose of mapping the connection points to the model ports directly.

NOTE 1 In some circumstances it may be necessary to assign the Connection_zones to model ports in order to characterize the functionality of the terminals more accurately.

NOTE 2 Part_device_terminal_model_port_assignment (see 5.2.4.366) may be used in conjunction with Part_feature_model_port_assignment (see 5.2.4.164) where this level of detail is not required.

The data associated with a Connection_zone_model_port_assignment are the following:

— source;

— target.

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4.2.150.1 source

The source specifies the role of the Connection_zone (see 4.2.147) for the Connection_zone_model_-port_assignment.

4.2.150.2 target

The target specifies the role of the Analytical_model_port (see 4.2.11) for the Connection_zone_model_-port_assignment.

4.2.151 Connectivity_allocation

A Connectivity_allocation is a type of Managed_design_object (see 4.2.431). A Connectivity_allocation is the relationship between a functional connectivity requirement and its implementation. The collection of functional terminals in the functional decomposition that are connected is allocated to one equivalent physical node. That equivalent physical node is an implementation in the Connectivity_allocation.

NOTE This part of ISO 10303 supports the capability to specify the paths through the functional decomposition that are reachable via terminals associated with given nodes. This is a statement of transitive closure for connectivity across the decomposition. This part of ISO 10303 does not separately represent a fully resolved functional node.

The data associated with a Connectivity_allocation are the following:

— connectivity_requirement;

— implementation.

4.2.151.1 connectivity_requirement

The connectivity_requirement specifies the role of the Aggregate_connectivity_requirement (see 4.2.4) for the Connectivity_allocation.

NOTE The connectivity_requirement effectively specifies one equivalent functional node.

4.2.151.2 implementation

The implementation specifies the role of the Physical_connectivity_definition (see 5.2.4.1) for the Connectivity_allocation.

Constraints:

UR1: The implementation shall be unique within a population of Connectivity_allocations.

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4.2.152 Connectivity_sub_structure

A Connectivity_sub_structure is a type of Managed_design_object (see 4.2.431). A Connectivity_sub_-structure is a group of connections in a structured physical connectivity definition as defined in Physical_-connectivity_structure_definition (see 5.2.4.147).

The data associated with a Connectivity_sub_structure are the following:

— members.

4.2.152.1 members

The members specify either the Component_terminal (see 4.2.105) or the Topological_junction (see 5.2.4.205) in the Connectivity_sub_structure. There shall be two or more Component_terminal in the Connectivity_sub_structure.

4.2.153 Consistent_part_template_shape_projection

A Consistent_part_template_shape_projection is a type of Managed_design_object (see 4.2.431). A Consistent_part_template_shape_projection is the projection into two dimensions of a part template shape in three dimensions. The projection is from the points on a cutting plane through the shape as specified by the shape representation of the planar shape. The cutting plane is considered to be a sampling plane.

The data associated with a Consistent_part_template_shape_projection are the following:

— projected_3d_shape;

— resultant_planar_shape.

4.2.153.1 projected_3d_shape

The projected_3d_shape specifies the Part_template_3d_shape (see 5.2.4.108) that is projected for the Consistent_part_template_shape_projection.

4.2.153.2 resultant_planar_shape

The resultant_planar_shape specifies the Part_template_planar_shape (see 5.2.4.314) that is the result of the projection of projected_3d_shape for the Consistent_part_template_shape_projection.

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4.2.154 Consistent_physical_unit_shape_projection

A Consistent_physical_unit_shape_projection is a type of Managed_design_object (see 4.2.431). A Consistent_physical_unit_shape_projection is the projection into two dimensions of a shape with three dimensions. The projection is from the points on a cutting plane through the shape as specified by the shape representation of the planar shape. The cutting plane is considered to be a sampling plane.

The data associated with a Consistent_physical_unit_shape_projection are the following:

— projected_3d_shape;

— resultant_planar_shape.

4.2.154.1 projected_3d_shape

The projected_3d_shape specifies the Physical_unit_3d_shape (see 4.2.534) that is projected for the Consistent_physical_unit_shape_projection.

4.2.154.2 resultant_planar_shape

The resultant_planar_shape specifies the Physical_unit_planar_shape (see 4.2.536) that is the result of projecting the projected_3d_shape for the Consistent_physical_unit_shape_projection.

4.2.155 Consistent_stratum_shape_projection

A Consistent_stratum_shape_projection is a type of Managed_design_object (see 4.2.431). A Consistent_stratum_shape_projection is the projection into two dimensions of a Stratum (see 4.2.677) shape with three dimensions. The projection is from the points on a cutting plane through the shape as specified by the shape representation of the planar shape. The cutting plane is considered to be a sampling plane.

The data associated with a Consistent_stratum_shape_projection are the following:

— projected_3d_shape;

— resultant_planar_shape.

4.2.155.1 projected_3d_shape

The projected_3d_shape specifies the Stratum_3d_shape (see 5.2.4.410) that is projected for the Consistent_stratum_shape_projection.

4.2.155.2 resultant_planar_shape

The resultant_planar_shape specifies the Stratum_planar_shape (see 5.2.4.206) that is the result of projecting the projected_3d_shape for the Consistent_stratum_shape_projection.

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4.2.156 Constraint_occurrence

A Constraint_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that limits possible solutions to the requirements specification by identifying boundary conditions for any potential solution. A Constraint_occurrence specifies a rule that must be satisfied. A Constraint_occurrence may be a Part_-based_constraint_occurrence (see 5.2.4.77).

EXAMPLE 1 A rule might exist that requires junction temperatures of Silicon based integrated devices to be less than 105 degrees Centrigade.

The data associated with a Constraint_occurrence are the following:

— design_constraint.

4.2.156.1 design_constraint

The design_constraint specifies the role of the Ee_rule_version (see 5.2.4.234) for the Constraint_occurrence.

4.2.157 Contact_size_dependent_land

A Contact_size_dependent_land is a type of Land (see 4.2.407) whose shape is dependent on the size of the contact area of the Component_terminal (see 4.2.105) that will be joined to the Contact_size_-dependent_land in the assembly.

EXAMPLE 1 Figure 5.2.4.117 is a detail that illustrates the Contact_size_dependent_land in relationship to the terminal that mates with it.

The data associated with a Contact_size_dependent_land are the following:

— usage_definition.

4.2.157.1 usage_definition

The usage_definition specifies the role of the Default_attachment_size_based_land_physical_template (see 5.2.4.118) for the Contact_size_dependent_land.

4.2.158 Contact_size_dependent_non_functional_land

A Contact_size_dependent_non_functional_land is a type of Non_functional_land (see 5.2.4.274) whose shape is dependent on the size of the contact area of the Component_terminal (see 4.2.105) that will be joined to the Contact_size_dependent_land (see 5.2.4.235) in the assembly.

The data associated with a Contact_size_dependent_non_functional_land are the following:

— usage_definition.

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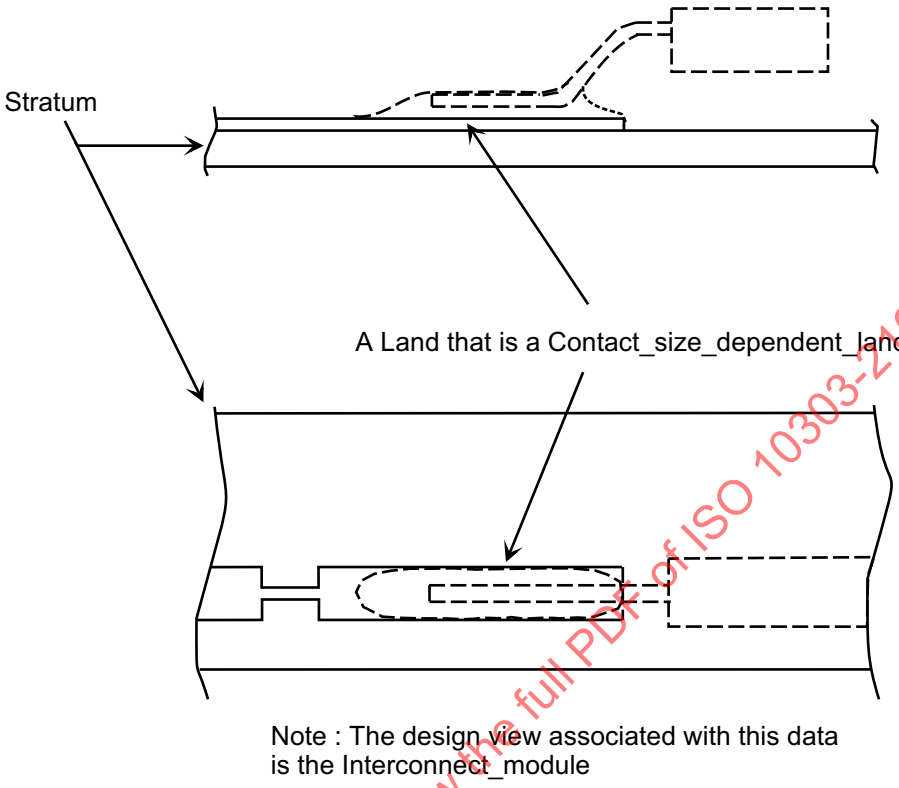

Figure 20 – Contact_size_dependent_land

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4.2.158.1 usage_definition

The usage_definition specifies the role of the Default_attachment_size_based_land_physical_template (see 5.2.4.118) for the Contact_size_dependent_non_functional_land.

4.2.159 Contract

A Contract is a type of Managed_design_object (see 4.2.431). A Contract is the identification of certain enterprise data related to a formal agreement between two business entities that is useful for managing product data.

NOTE This part of ISO 10303 does not support the exchange of the contents of a contract.

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The data associated with a Contract are the following:

— contractor;

— contract_approval;

— contract_date;

— contract_number.

4.2.159.1 contractor

The contractor specifies either the Person_and_organization (see 5.2.4.275) or the Organization (see 5.2.4.135) performing work under the scope of the Contract. The contractor need not be specified for a particular Contract.

4.2.159.2 contract_approval

The contract_approval specifies the role of the Ee_approval (see 4.2.269) for the Contract.

4.2.159.3 contract_date

The contract_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) for the Contract.

4.2.159.4 contract_number

The contract_number specifies the role of the Ee_text (see 4.2.293) for the identifier of the Contract.

Constraints:

UR1: The contract_number shall be unique within a population of Contracts.

4.2.160 Coordinated_characteristic

A Coordinated_characteristic is a type of Managed_design_object (see 4.2.431) that may include more than one discrete Characteristic (see 4.2.77) and that is dependent upon a specified environment for its validity. A Coordinated_characteristic may be a Tolerance_characteristic (see 5.2.4.168). The members of component_characteristic shall be coordinated in accordance with the definition associated with the type_name in the reference_document.

NOTE This part of ISO 10303 predefines several categories of Tolerance_characteristic.

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The data associated with a Coordinated_characteristic are the following:

— component_characteristic;

— dependent_environment;

— reference_document;

— type_name.

EXAMPLE 1 An example of coordinated_characteristic is Poisson's ratio. This measurement, for some materials, is dependent upon the orientation of the measurement relative to the specimen being measured. Poisson's ratio, as a characteristic, is specified by three values of stress strain ratio along three orthogonal axes where one axis is along a characteristic direction of the material being described.

4.2.160.1 component_characteristic

The component_characteristic specifies the Characteristic (see 4.2.77) for the Coordinated_characteristic. There shall be one or more Characteristic for a Coordinated_characteristic.

4.2.160.2 dependent_environment

The dependent_environment specifies the text that describes the environment under which the Coordinated_characteristic is valid. The dependent_environment need not be specified for a particular Coordinated_characteristic.

4.2.160.3 reference_document

The reference_document specifies the Ee_document (see 4.2.271) or an identifier of the standard document for the type of Coordinated_characteristic.

4.2.160.4 type_name

The type_name specifies the string, defined in the reference_document, for the type of Coordinated_characteristic.

4.2.161 Counterbore_passage_template

A Counterbore_passage_template is a type of Unsupported_passage_template (see 4.2.756). A Counterbore_passage_template is a combination of two round coaxial passages. The first passage is either a through-hole or a blind hole, and the orientation of the second passage (the counterbore) is the same as that of the first passage. The first passage is smaller than the second passage, which has a blind bottom condition that mates with the top of the first passage.

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The data associated with a Counterbore_passage_template are the following:

— larger_passage;

— smaller_passage.

4.2.161.1 larger_passage

The larger_passage specifies the Blind_passage_template (see 4.2.52) for the Counterbore_passage_template. The larger_passage specifies the data that is associated with the larger opening of the Counterbore.

4.2.161.2 smaller_passage

The smaller_passage specifies the Unsupported_passage_template (see 4.2.756) for the Counterbore_passage_template. The smaller_passage specifies the data that is associated with the smaller opening of the Counterbore.

4.2.162 Countersunk_passage_template

A Countersunk_passage_template is a type of Unsupported_passage_template (see 4.2.756). A Countersunk_passage_template is a combination of two round coaxial passages, one cylindrical and one tapered. The initial diameter of the tapered passage will be larger than the diameter of the cylindrical passage, and will linearly taper to be the same diameter as the cylindrical passage where the two passages meet.

The data associated with a Countersunk_passage_template are the following:

— constant_diameter_passage;

— tapered_passage.

4.2.162.1 constant_diameter_passage

The constant_diameter_passage specifies the Unsupported_passage_template (see 4.2.756) for the Countersunk_passage_template. The constant_diameter_passage specifies the data that is associated with the constant diameter opening of the Countersunk passage.

4.2.162.2 tapered_passage

The tapered_passage specifies the Blind_passage_template (see 4.2.52) for the Countersunk_passage_template. The tapered_passage specifies the data that is associated with the tapered area of the Countersunk passage.

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4.2.163 Csg_primitive

A Csg_primitive is a type of Managed_design_object (see 4.2.431). A Csg_primitive is either a Right_-angular_wedge (see 5.2.4.294), or a Right_circular_cylinder (see 5.2.4.295), or a Block (see 4.2.54). A Csg_primitive is used in forming a "CSG" solid model.

4.2.164 Csg_solid

A Csg_solid is a type of Bound_volume_shape (see 4.2.58). A Csg_solid is a solid represented as a CSG model that is defined by a collection of primitive solids, combined using regularized boolean operations. The allowed operations are intersection, union and difference. Csg_solids may be used in conjunction with other solid models and boolean operations to construct larger solid models.

4.2.165 Curve

A Curve is a type of Feature_shape_definition (see 4.2.315). A Curve may be a Bounding_curve (see 4.2.62) or a Closed_curve (see 4.2.80), or additionally may be a Composite_curve (see 5.2.4.112) or additionally may be a Trimmed_line (see 4.2.752). A Curve is the path of a point moving through its three-dimensional coordinate space or of a point moving through its two-dimensional coordinate space. A Curve shall be arc-wise connected. A Curve shall have an arc length greater than zero.

4.2.166 Curve_dimension

A Curve_dimension is a type of Single_boundary_dimension (see 4.2.661) that is measured along the entire path of the characterized Shape_element (see 4.2.645) the form of which is that of a curve.

NOTE 1 The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

NOTE 2 The attribute size_of is declared in the Dimensional_size entity of which this entity is a subtype.

Constraints:

WR1: The dimension_type of the Curve_dimension shall not be "angular".

IP1: The form of the Shape_element that is specified as the size_of shall be consistent with the form of a curve.

4.2.167 Curve_style

A Curve_style is a type of Managed_design_object (see 4.2.431). A Curve_style is the definition of a set of properties that are of a geometric nature. Curve_style provides parametric data used by a processor to create physical material along a path, where the path is described outside of the style. The Curve_style algorithm is rule based and is formally described in the domain rules.

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The data associated with a Curve_style are the following:

— corner_style;

— curve_font;

— curve_width;

— end_extension;

— end_style;

— name.

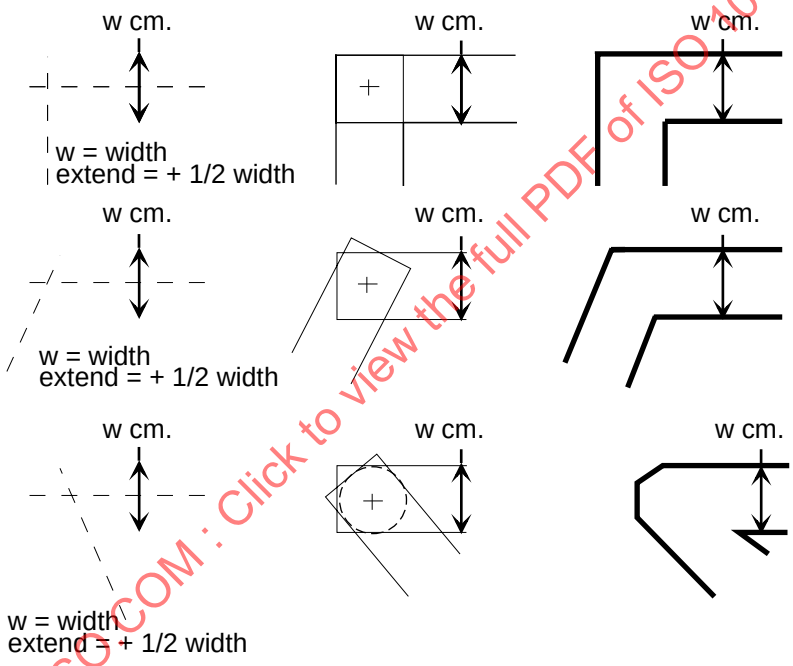

Figure 21 – Square corners with extend

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4.2.167.1 corner_style

The corner_style specifies either the "extend" or "chord 2 extend" or "round" or "truncate" style for the Curve_style. Figures 5.2.4.292 and 5.2.4.367 illustrate the construction options associated with "extend", "chord 2 extend" and "truncate" corners. These illustrations shall be interpreted as describing construction of the outer boundary near the intersection only. At some distance away from the intersection, the basic width attribute governs the shape. Figure 5.2.4.28 illustrates the construction associated with round corners. Figure 5.2.4.173 illustrates the construction of the end treatment of the curve. The end treatment is applied individually to each end. Figure 5.2.4.174 illustrates the completed result for a Curve (see 4.2.165) that has been styled using this Curve_style. Even though the Curve does not show material inside, that is required if the Curve is applied to material.

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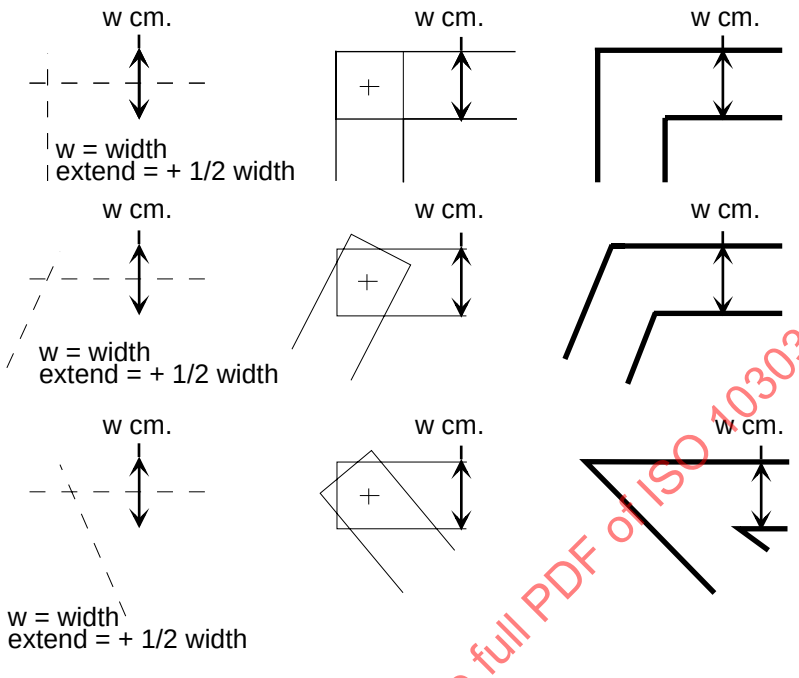

Figure 22 – Corners with positive extend

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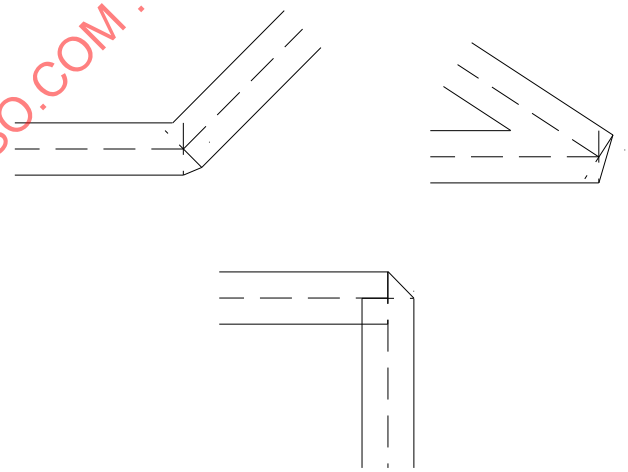

Figure 23 – Square corners with truncate

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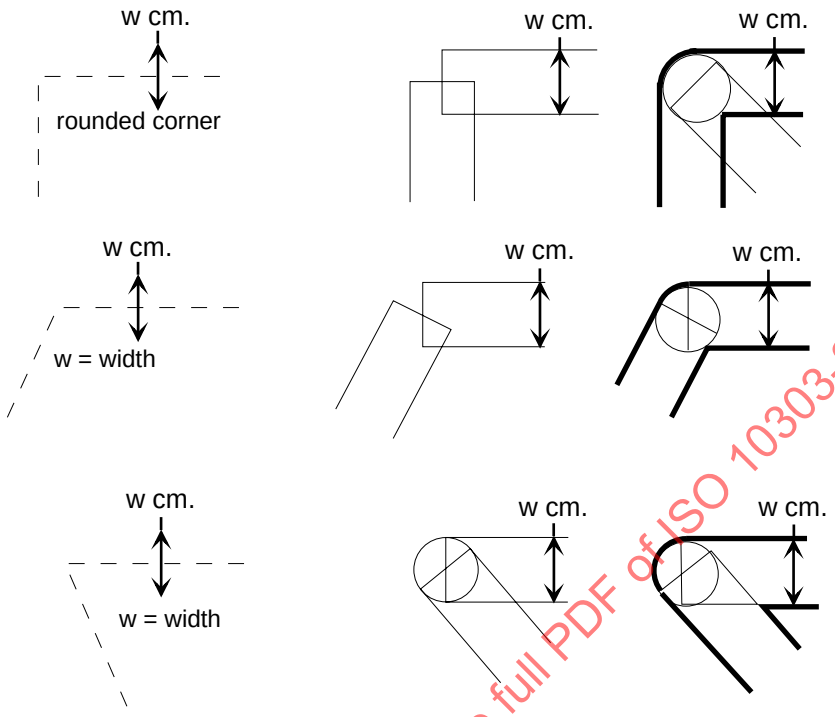

Figure 24 – Round corners

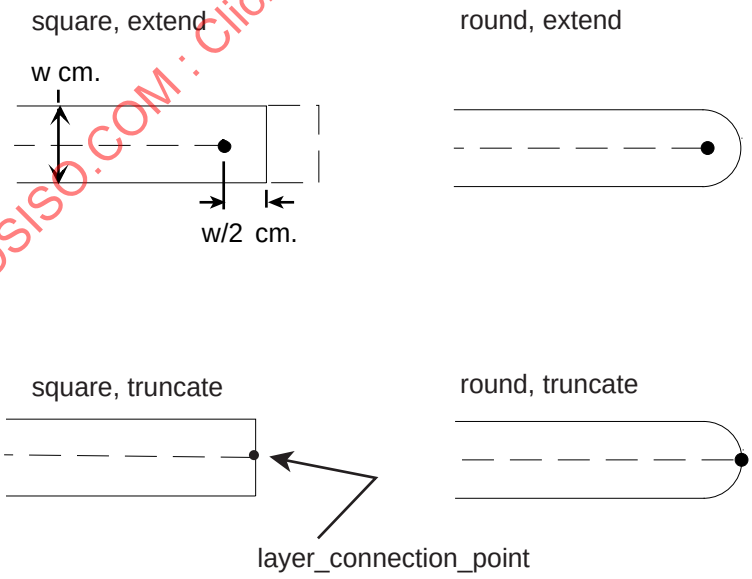

Figure 25 – Curve end treatment

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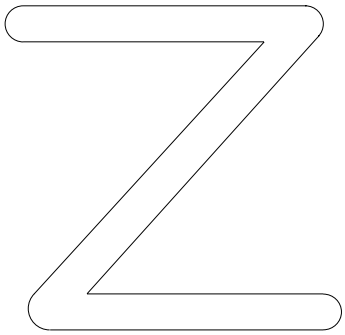

Curve_style.corner_style = round
Curve_style.end_style = round
Curve_style.end_extension = extend

Figure 26 – Completed curve

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4.2.167.2 curve_font

The curve_font specifies either the Curve_style_font_and_scaling (see 5.2.4.260), or one of Curve_-style_font (see 5.2.4.290), Externally_defined_curve_font (see 5.2.4.291), or Solid_curve (see 5.2.4.286) for the Curve_style. The curve_font need not be specified.

4.2.167.3 curve_width

The curve_width specifies the role of the Length_data_element (see 4.2.422) for the Curve_style.

4.2.167.4 end_extension

The end_extension specifies how the physical material will terminate on the Layer_connection_point (see 5.2.4.420) that is the start or end of the centreline curve. The end_extension is applied by a continuation (termination) of the Curve (see 4.2.165) that is being styled along the tangent to the Curve at the terminus of the Curve. If the end_extension is "extend", there will be material added after the Layer_connection_-point. If the end_extension is "truncate", there will be no material added after the Layer_connection_-point.

NOTE This Application Object does not describe tolerances associated with fabrication processes. Reference Stratum_technology (see 4.2.702) as an example of tolerance information related to fabrication processes.

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4.2.167.5 end_style

The end_style specifies either the "round" or "square" style endsfor the Curve_style. Figures 5.2.4.292 and 5.2.4.367 illustrate the construction options associated with square corners. These illustrations shall be interpreted as describing construction of the outer boundary near the end only. At some distance away from the end, the basic width attribute governs the shape. Figure 5.2.4.173 illustrates the construction of the end treatment of the curve. The end treatment is applied individually to each end. Figure 5.2.4.174 illustrates the completed result for a Curve (see 4.2.165) that has been styled using this Curve_style. Even though the Curve does not show material inside, that is required if the Curve is applied to material.

4.2.167.6 name

The name specifies the string for the identifier for the Curve_style.

Constraints:

UR1: The name shall be unique within a population of Curve_style.

WR1: When the end_extension is "truncate", the Layer_connection_point for the end of interest shall be the terminus of the curve.

WR2: When the end_style is "square", the centreline of the square shall be congruent with the tangent of the centreline curve at the Layer_connection_point for the end of interest.

WR3: When the end_style is "round" and the end_extension is "extend", the Layer_connection_point for the end of interest shall be the center of a circle with radius equal to 0.5 times width.

WR4: When the end_style is "square" and the end_extension is "extend", the Layer_connection_point for the end of interest shall be the center of a square with side equal to the width.

WR5: When the corner_style is "extend", the final shape shall be the result of a union operation and a fill operation. The union operation shall be between the styled curve segments approaching the Cartesian_-point of interest in the neighbourho od of the Cartesian_point. The fill operation shall maximize the material enclosed while maintaining the following conditions: The fill boundary shall be two lines that are extensions of the right hand boundary of the filled material as it traverses the corner, in the direction of the centreline curve.

WR6: When the corner_style is "chord 2 extend", the final shape shall be the result of an intersection and fill operation between the styled curve segments approaching the Cartesian_point of interest in the neighbourhood of the Cartesian_point, where there is a 2 chord approximation to a circular arc applied, which has radius equal to 0.5 times width. The final shape shall be the result of a fill operation after the union operation is performed between the styled curve segments approaching the Cartesian_point of interest in the neighbourhood of the Cartesian_point. The circular arc shall be constructed as required by the "round" corner_style rule.

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WR7: When the corner_style is "truncate", the final shape shall be the result of an union operation followed by a fill operation. The union operation shall be between the styled curve segments approaching the Cartesian_point of interest in the neighbourhood of the Cartesian_point, where there is a bevel end applied. The final shape shall be the result of a fill operation after the union operation is performed between the styled curve segments approaching the Cartesian_point of interest in the neighbourhood of the Cartesian_point. The fill operation shall maximize the material enclosed while maintaining the following conditions: The fill boundary line shall be perpendicular to the angle bisector formed between the two Curve segments at the Cartesian_point of interest; the fill boundary line shall intersect the previously described result of the union operation in exactly two places; the fill boundary line shall not contain the Cartesian_point of interest.

WR8: When the corner_style is "round", the final shape shall be the result of a union operation between the styled curve segments approaching the Cartesian_point of interest in the neighbourhood of the Cartesian_point, followed by a fill operation with a circular arc of radius 0.5 times width applied. The circular arc shall be centred on the Cartesian_point.

WR9: When the Curve to which the Curve_style is applied is closed, end_treatment shall be ignored.

4.2.168 Curve_style_font

A Curve_style_font is a type of Managed_design_object (see 4.2.431). A Curve_style_font is the computer interpretable font used to present the Curve (see 4.2.165).

4.2.169 Curve_style_font_and_scaling

A Curve_style_font_and_scaling is a type of Managed_design_object (see 4.2.431). A Curve_style_font_and_scaling is the combination of the computer interpretable font and the scale factor for that font used to present the Curve (see 4.2.165).

The data associated with a Curve_style_font_and_scaling are the following:

— curve_font;

— curve_font_scaling;

— name.

4.2.169.1 curve_font

The curve_font specifies either a Curve_style_font (see 5.2.4.290), Curve_style_font, an Externally_defined_curve_font (see 5.2.4.291), Externally_defined_curve_font, or a Solid_curve (see 5.2.4.286), Solid_curve for the Curve_style_font_and_scaling.

4.2.169.2 curve_font_scaling

The curve_font_scaling specifies the Positive_ratio_measure (see 4.2.567) used for the Curve_style_font_and_scaling.

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4.2.169.3 name

The name specifies the string used for the identifier for the combination of Curve_style_font_and_-scaling.

Constraints:

UR1: The name shall be unique within a population of Curve_style_font_and_scaling.

4.2.170 Cutout

A Cutout is a type of Inter_stratum_feature (see 4.2.364). A Cutout may be a Physical_connectivity_-interrupting_cutout (see 5.2.4.5). A Cutout is a closed, internal shape in a substrate. A Cutout may not extend completely through the substrate. Complex Cutouts may be created by using the facilities in Assembly_group_component (see 4.2.31).

EXAMPLE 1 Figure 5.2.4.20 illustrates the information required to fabricate the interconnect substrate and also assemble a component onto the interconnect. The Cutout illustrated has a form that is dependent on the component installed in it. Each end of the internal conductor path shown in the figure that mates with a component terminal should be modeled as an Interconnect_module_component_terminal (see 4.2.376). During design of the interconnect substrate, thees features would be considered as interface features whose location is controlled by the mating requirement. In this example the mating requirement is simplified because the component is not a connector.

EXAMPLE 2 Figure 5.2.4.26 illustrates a detail that shows information required to fabricate the interconnect substrate. The Cutout illustrated includes a blind passage at the base. The blind passage would be defined by a Blind_passage_template (see 4.2.52).

Constraints:

WR1: A Cutout shall not form part of the edge of the Interconnect_module.

4.2.171 Cutout_edge_segment

A Cutout_edge_segment is a type of Inter_stratum_feature (see 4.2.364) that defines an edge segment of a Cutout (see 5.2.4.31). When the Cutout_edge_segment participates in a Cutout that is fully described by a collection of Cutout_edge_segment, the end_vertex of the final segment shall be the start_vertex of the first segment. Adjacent Cutout_edge_segment reference the same member of Edge_segment_vertex (see 5.2.4.70) but in different roles to ensure continuity.

EXAMPLE 1 Figure 5.2.4.71 illustrates a Cutout_edge_segment.

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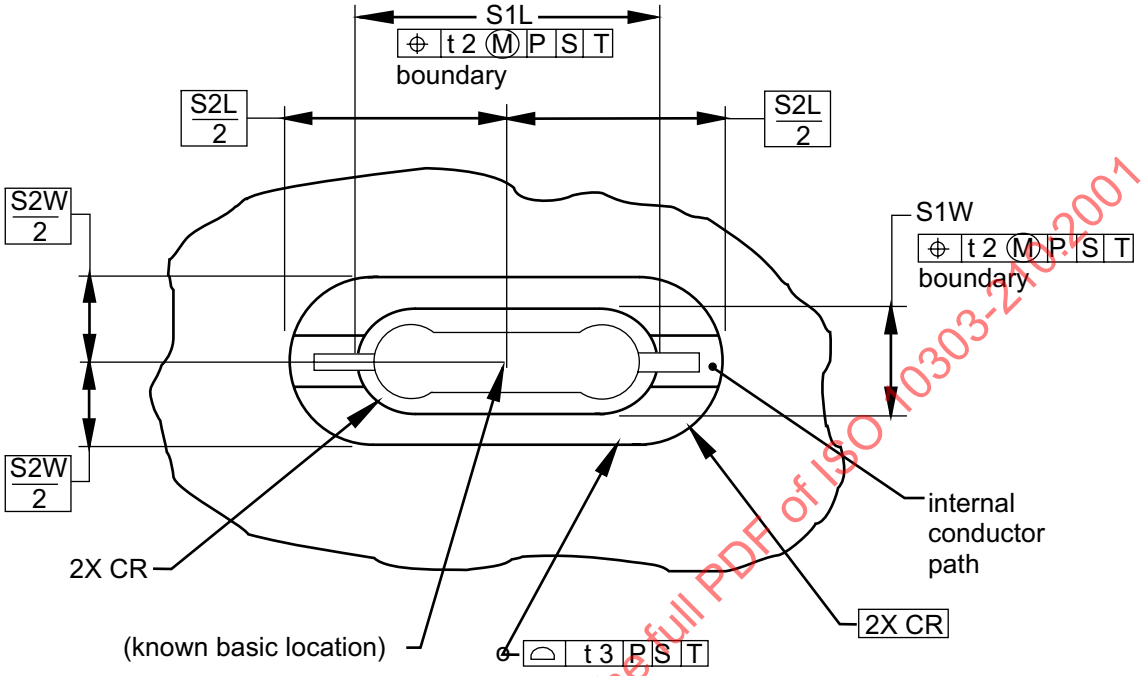

Figure 27 – Cutout plan view showing installed component

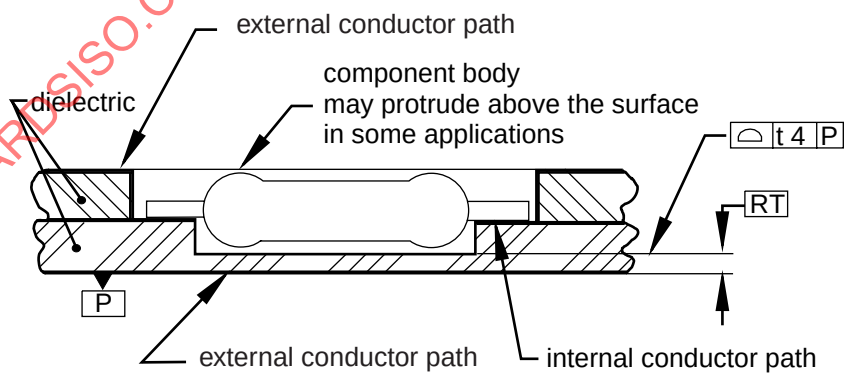

Figure 28 – Cutout cross-section view showing installed component

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The data associated with a Cutout_edge_segment are the following:

— composed_cutout;

— end_vertex;

— start_vertex.

NOTE Some Cutouts have edges that differ in cross-section shape. This object is to describe one segment of the edge of one member of that type.

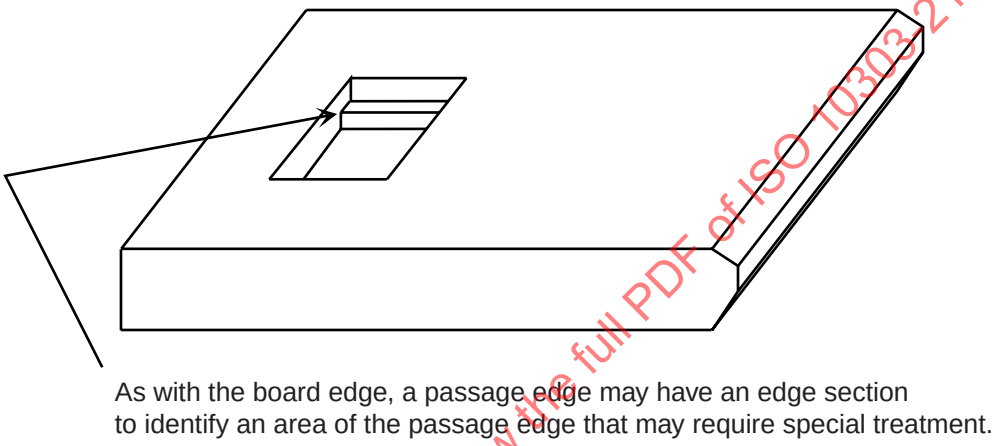

Figure 29 – Cutout_edge_segment

4.2.171.1 composed_cutout

The composed_cutout specifies the Cutout (see 5.2.4.31) that contains the Cutout_edge_segment.

4.2.171.2 end_vertex

The end_vertex specifies one role of an Edge_segment_vertex for the Cutout_edge_segment.

4.2.171.3 start_vertex

The start_vertex specifies one role of an Edge_segment_vertex for the Cutout_edge_segment.

Constraints:

WR1: The Cutout_edge_segment shall help to compose only inner features of the Interconnect_module

WR2: The start_vertex shall not be the end_vertex.

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4.2.172 Cylindricity_tolerance

A Cylindricity_tolerance is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) that specifies or partially specifies the design requirement on the cylindricity of the Physical_feature_-or_part_template (see 4.2.527) to which the Cylindricity_tolerance is applied.

NOTE Cylindricity tolerance is defined in terms of a tolerance zone definition in 14.4 of ISO 1101.

Constraints:

WR1: The Shape_element specified by the toleranced_shape_element shall be a Physical_feature_or_-part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Cylindricity_tolerance shall not be a Geometric_tolerance_with_applied_material_condi-tion_property.

WR3: The Cylindricity_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_-boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_def-inition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_-with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_bound-ary_size.

IP1: The form of the toleranced Physical_feature_or_part_template shall be consistent with the form of a feature for which the application of a cylindricity tolerance is sensible.

4.2.173 Data_element

A Data_element is a type of Managed_design_object (see 4.2.431). A Data_element may be an Angle_-data_element (see 4.2.17) or a Length_data_element (see 4.2.422), or additionally may be a Qualified_-data_element (see 4.2.606). A Data_element is a quantitative value that includes the measurement units associated with the value. This part of ISO 10303 predefines base units from which user defined un its may be mapped. ISO 10303-41 defines the mechanism for mapping between user defined units and predefined units.

The data associated with a Data_element are the following:

— measure_value;

— unit_of_measure.

4.2.173.1 measure_value

The measure_value specifies the REAL type for the Data_element. The interpretation of the measure_-value shall be in accordance with the unit_of_measure.

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4.2.173.2 unit_of_measure

The unit_of_measure specifies the descriptive label for the unit of measure for the associated measure_-value of the Data_element. The units may be SI, derived from SI, or context dependent, and may have prefixes included whose syntax is defined in ISO 10303-41 and whose semantic is defined in ISO 31.

4.2.174 Date

A Date is a type of Managed_design_object (see 4.2.431). A Date may be a Date_and_time (see 4.2.175). The Date is the day of the calendar.

The data associated with a Date are the following:

— day;

— month;

— year.

4.2.174.1 day

The day specifies the integer for the day of the month for the Date.

4.2.174.2 month

The month specifies the integer for the month representation for the Date.

NOTE These integers range between 1 and 12, inclusively.

4.2.174.3 year

The year specifies the integer for the year of the Date.

Constraints:

WR1: The year shall be a four digit positive integer.

4.2.175 Date_and_time

A Date_and_time is a type of Date (see 4.2.174) that includes the clock time together with the calendar Date. Resolution to the second is provided by this object.

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The data associated with a Date_and_time are the following:

— hour;

— minute;

— second;

— time_zone.

4.2.175.1 hour

The hour specifies the integer for the period of clock time consisting of sixty minutes, for the Date_and_-time.

4.2.175.2 minute

The minute specifies the integer for the period of clock time consisting of sixty seconds, for the Date_-and_time.

4.2.175.3 second

The second specifies the integer for the second portion of the clock time for the Date_and_time.

4.2.175.4 time_zone

The time_zone specifies the integer number of hours that the local time is offset from coordinated universal time, and the direction of the offset, for the Date_and_time.

4.2.176 Datum

A Datum is a type of Non_feature_shape_element (see 5.2.4.127) that is a theoretically exact geometric reference such as a point, an axis, or a plane, to which toleranced Shape_element (see 4.2.645) are related. Each Datum is either a Datum_point (see 5.2.4.128) or a Datum_axis (see 4.2.177) or a Datum_plane (see 5.2.4.129). Additionally each Datum may be either a Single_datum (see 5.2.4.130) or a Common_datum (see 4.2.81).

EXAMPLE 1 Figure 5.2.4.131 illustrates the usage of a Datum.

NOTE Datums are described in clause 8 of ISO 1101.

The data associated with a Datum are the following:

— datum_feature_usages.

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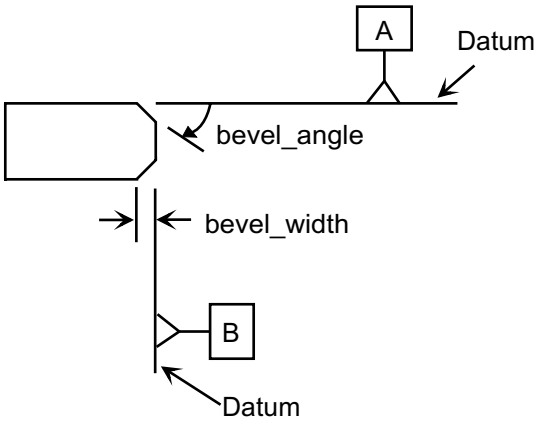

Figure 30 – Datum

4.2.176.1 datum_feature_usages

The datum_feature_usages is an inverse relationship that specifies that the Datum may be referenced by Datum_feature_usage_in_datum_relationship (see 5.2.4.132) that specifies the Datum as its relating_shape_element. The datum_feature_usages need not be specified for a particular Datum.

Constraints:

WR1: A Datum shall be a Datum_axis, Datum_plane, or Datum_point.

4.2.177 Datum_axis

A Datum_axis is a type of Datum (see 4.2.176) that is a theoretically exact axis to which toleranced Shape_element (see 4.2.645) are related.

Constraints:

WR1: If the Datum_axis is not specified as a reference_axes by a Datum_reference_frame then the Datum_axis shall be either a Common_datum, or a Single_datum.

4.2.178 Datum_axis_and_tolerance_zone_orienting_relationship

A Datum_axis_and_tolerance_zone_orienting_relationship is a type of Managed_design_object (see 4.2.431). A Datum_axis_and_tolerance_zone_orienting_relationship is a relationship that associates a Tolerance_zone (see 4.2.732) with the Datum_axis (see 4.2.177) by which it is oriented.

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The data associated with a Datum_axis_and_tolerance_zone_orienting_relationship are the following:

— oriented_tolerance_zone;

— orienting_datum_axis;

— zone_orientation.

4.2.178.1 oriented_tolerance_zone

The oriented_tolerance_zone specifies the Tolerance_zone (see 4.2.732) that is oriented with respect to the Datum_axis (see 4.2.177) specified as the orienting_datum_axis.

4.2.178.2 orienting_datum_axis

The orienting_datum_axis specifies the Datum_axis (see 4.2.177) by which the Tolerance_zone (see 4.2.732) that is specified as the oriented_tolerance_zone is oriented.

4.2.178.3 zone_orientation

The zone_orientation is an inverse relationship that specifies that the existence of the Datum_axis_-and_tolerance_zone_orienting_relationship is dependent on the existence of the Datum_axis_related_-orientation (see 5.2.4.139) that specifies the Datum_axis_and_tolerance_zone_orienting_relationship as its orienting_relationship.

4.2.179 Datum_axis_related_orientation

A Datum_axis_related_orientation is a type of Managed_design_object (see 4.2.431). A Datum_axis_-related_orientation is a definition that characterizes the orientation of a Tolerance_zone (see 4.2.732) in relation to a Datum_axis (see 4.2.177).

The data associated with a Datum_axis_related_orientation are the following:

— orientation_type;

— orienting_relationship.

4.2.179.1 orientation_type

The orientation_type specifies a label that indicates the manner in which the specified Tolerance_zone (see 4.2.732) is oriented with respect to the specified Datum_axis (see 4.2.177). The orientation_type shall either be "centred_on_arc", or "centred_on_radial".

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EXAMPLE 1 In the polar coordinate method of bidirectional positional tolerancing the bidirectional tolerance zone consists of two tolerance zones. One that is bounded by a pair of parallel planes that is centred along a radial from the datum axis and another that is bounded by a pair of concentric cylindrical arc boundaries that are centred along a cylindrical arc the origin of which is the datum axis. An orientation_type of "centred_on_radial" corresponds to the first tolerance zone and "centred_on_arc" corresponds to the second tolerance zone.

NOTE The polar method of bidirectional positional tolerancing is discussed in 5.9.2 of ASME Y14.5M.

4.2.179.2 orienting_relationship

The orienting_relationship specifies the Datum_axis_and_tolerance_zone_orienting_relationship (see 5.2.4.133) that associates the Tolerance_zone (see 4.2.732) with the Datum_axis (see 4.2.177) with which it is oriented. The specified Datum_axis_and_tolerance_zone_orienting_relationship is characterized by the Datum_axis_related_orientation.

Constraints:

WR1: The Datum_axis_related_orientation shall be specified as the zone_orientation by exactly one Tolerance_zone_definition_with_specified_orientation.

4.2.180 Datum_based_direction_vector

A Datum_based_direction_vector is a type of Managed_design_object (see 4.2.431). A Datum_based_-direction_vector is a characterization of a direction away from and normal to a Datum_plane (see 5.2.4.129).

The data associated with a Datum_based_direction_vector are the following:

— direction_vector_representation;

— positive_direction_vector;

— vector_of.

4.2.180.1 direction_vector_representation

The direction_vector_representation specifies an Axis_placement (see 4.2.43) that is a representation for the Datum_based_direction_vector.

4.2.180.2 positive_direction_vector

The positive_direction_vector specifies a boolean value that indicates whether the Datum_based_direction_vector is in a positive or negative sense. A value of TRUE indicates that the Datum_based_direction_vector is in the positive sense. A value of FALSE indicates that the Datum_based_direction_vector is in the negative sense.

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4.2.180.3 vector_of

The vector_of specifies the Datum_plane (see 5.2.4.129) from which the Datum_based_direction_vector is based.

Constraints:

WR1: The Datum_based_direction_vector shall be specified as the direction by at least one Direction_-element.

4.2.181 Datum_based_length_measure

A Datum_based_length_measure is a type of Managed_design_object (see 4.2.431). A Datum_based_-length_measure is a dimensional measure of length that is taken from a defined Datum (see 4.2.176).

EXAMPLE 1 Figure 5.2.4.196 illustrates the usage of a Datum_based_length_measure.

The data associated with a Datum_based_length_measure are the following:

— measure;

— measure_orientation;

— of_datum.

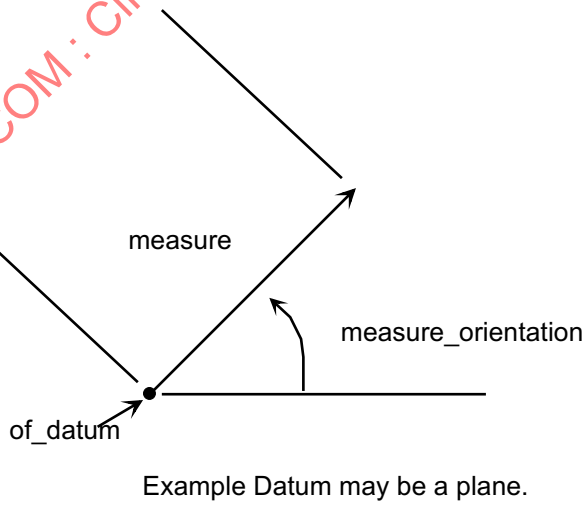

Figure 31 – Datum_based_length_measure

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4.2.181.1 measure

The measure specifies the role of the Length_data_element (see 4.2.422) for the Datum_based_length_-measure.

4.2.181.2 measure_orientation

The measure_orientation specifies the role of the Orientation (see 4.2.465) for the Datum_based_length_-measure or specifies the role of the string 'normal' or specifies the role of the string 'reversed'. 'Normal' shall be interpreted as a description equivalent to the three dimensional concept of a vector parallel to the normal of the plane that is the datum upon which the Datum_based_length_measure is based. 'Reversed' shall be interpreted as a description equivalent to the three dimensional concept of a vector anti-parallel to the normal of the plane that is the datum upon which the Datum_based_length_measure is based. For the case that the Datum is a Datum_plane, the Orientation vector shall be in the XZ plane of the Datum_-plane, where the Z axis is the normal vector of the Datum_plane. The measure_orientation is measured from the X axis in the XZ plane. For the two-dimensional case, the Datum_plane if used, is considered to be congruent with the XY coordinate system.

NOTE The use of descriptive items allows the information to be conveyed when the geometric context is 2d, since orientation only supports a description within a 3d geometric context.

4.2.181.3 of_datum

The of_datum specifies the role of the Datum_plane (see 5.2.4.129) for the Datum_based_length_mea-sure. A Datum_plane is required in order to support equivalent description between the 2d and 3d shape representation cases.

4.2.182 Datum_based_vector_orientation

A Datum_based_vector_orientation is a type of Managed_design_object (see 4.2.431). A Datum_-based_vector_orientation is a definition of the orientation of a shape element that has the form of a vector and is based on the intersection of two shape elements that have the form of half-planes. Where a half-plane has the form of a plane except it is bounded on one side by a straight line. Each half-plane shape element is oriented with respect to three Datum_plane (see 5.2.4.129) and is defined by a Direction_element (see 5.2.4.213).

The data associated with a Datum_based_vector_orientation are the following:

— direction_components.

4.2.182.1 direction_components

The direction_components specifies the Direction_element (see 5.2.4.213) that defines the half-plane shape elements the intersection of which forms the vector that is defined by the Datum_based_vector_-orientation. There shall be exactly two Direction_element for the Datum_based_vector_orientation.

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Constraints:

WR1: The Datum_based_vector_orientation shall be specified as the zone_orientation by at least one Tolerance_zone_definition_with_specified_orientation, or as the measurement_direction by at least one Dimension_location_with_direction_vector, or as the measurement_orientation by at least one Angular_-dimension_with_direction_vector.

WR2: The Datum_planes specified as the base_datum_plane by the two Direction_element specified as direction_components shall be different.

WR3: The Datum_planes specified as the base_datum_plane by the two Direction_element specified as direction_components shall be Datum_planes of the same Datum_reference_frame.

4.2.183 Datum_difference

A Datum_difference is a type of Composite_unit_shape_element (see 5.2.4.63). A Datum_difference is the basis for mapping from a geometric context model into a lexical context model for definitional purposes. A Datum_difference identifies the length or angular difference between two Datum. The difference may be referenced independently of the originating geometric model representation.

NOTE 1 One Datum may be located at the origin if a simple location is intended.

NOTE 2 The origin reference for a simple angular difference should be the X axis for two-dimensional case, and the XY axis for three-dimesional case.

The data associated with a Datum_difference are the following:

— precedent_datum;

— subsequent_datum.

4.2.183.1 precedent_datum

A precedent_datum specifies one role of a Datum (see 4.2.176) for a Datum_difference. The precedent_-datum is the reference datum.

4.2.183.2 subsequent_datum

A subsequent_datum specifies one role of a Datum (see 4.2.176) for a Datum_difference. The subse-quent_datum is the measureand.

4.2.184 Datum_difference_analytical_model_port_assignment

A Datum_difference_analytical_model_port_assignment is a type of Managed_design_object (see 4.2.431). A Datum_difference_analytical_model_port_assignment is provided to map from the geometric context into a specific Analytical_model through its ports. The use of Datum_difference (see 5.2.4.207) isolates the model ports from a specific geometric representation.

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The data associated with a Datum_difference_analytical_model_port_assignment are the following:

— assigned_analytical_model_port;

— of_datum_difference.

4.2.184.1 assigned_analytical_model_port

An assigned_analytical_model_port specifies the role of the Analytical_model_port (see 4.2.11) for the Datum_difference_analytical_model_port_assignment.

4.2.184.2 of_datum_difference

An of_datum_difference specifies the role of the Datum_difference (see 5.2.4.207) for the Datum_difference_analytical_model_port_assignment.

4.2.185 Datum_difference_based_characteristic

A Datum_difference_based_characteristic is a type of Characteristic (see 4.2.77). A Datum_difference_based_characteristic is provided to allow characterization based on a geometric model. This is typically used where there is a reference geometric model available.

The data associated with a Datum_difference_based_characteristic are the following:

— of_datum_difference.

4.2.185.1 of_datum_difference

An of_datum_difference specifies the role of the Datum_difference (see 5.2.4.207) for the Datum_difference_based_characteristic.

4.2.186 Datum_difference_based_model_parameter

A Datum_difference_based_model_parameter is a type of Model_parameter (see 4.2.451). In effect, the Datum_difference provides a geometric basis for the definition of the Model_parameter.

The data associated with a Datum_difference_based_model_parameter are the following:

— of_datum_difference.

4.2.186.1 of_datum_difference

An of_datum_difference specifies the role of the Datum_difference (see 5.2.4.207) for the Datum_difference_based_model_parameter.

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4.2.187 Datum_difference_functional_unit_usage_view_terminal_assignment

A Datum_difference_functional_unit_usage_view_terminal_assignment is a type of Managed_design_-object (see 4.2.431). A Datum_difference_functional_unit_usage_view_terminal_assignment provides the ability to map from a geometric context into the functional context of a Functional_unit_definition (see 5.2.4.305).

The data associated with a Datum_difference_functional_unit_usage_view_terminal_assignment are the following:

— assigned_functional_terminal_definition;

— assigned_datum_difference.

4.2.187.1 assigned_functional_terminal_definition

An assigned_functional_terminal_definition specifies the role of the Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for the Datum_difference_functional_unit_usage_view_terminal_assignment.

4.2.187.2 assigned_datum_difference

An assigned_datum_difference specifies the role of the Datum_difference (see 5.2.4.207) for the Datum_difference_functional_unit_usage_view_terminal_assignment.

4.2.188 Datum_feature

A Datum_feature is a type of Physical_feature_or_part_template (see 4.2.527) that is used to establish one or more Datum (see 4.2.176). A Datum_feature may be a Datum_target_set (see 5.2.4.338). A Datum_feature may be used to establish one Single_datum (see 5.2.4.130), and one or more Common_-datum (see 4.2.81).

NOTE The definition of datum feature is given in 3.3 of ISO 5459.

The data associated with a Datum_feature are the following:

— datum_feature_usages;

— identification.

4.2.188.1 datum_feature_usages

The datum_feature_usages is an inverse relationship that specifies that the existence of the Datum_feature is dependent on the existence of the Datum_feature_usage_in_datum_relationship (see 5.2.4.132) that specifies the Datum_feature as its related_shape_element. There shall be one or more Datum_feature_-usage_in_datum_relationship for a Datum_feature.

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4.2.188.2 identification

The identification specifies the label by which the Datum_feature is referred.

NOTE Datum (see 4.2.176) letter identifiers are examples of identifiers of Datum features. The Datum letter identifier is described in 6.1.2 of ISO 5459.

Constraints:

WR1: A Datum_feature shall be used to establish at most one Single_datum.

4.2.189 Datum_feature_material_condition_property

A Datum_feature_material_condition_property is a type of Managed_design_object (see 4.2.431). A Datum_feature_material_condition_property is a specification of a material condition property that defines the manner in which Geometric_tolerance_with_referenced_datum_system (see 4.2.357) requirements are dependent on the produced size of a Datum_feature (see 4.2.188) of the Datum_system (see 5.2.4.316).

The data associated with a Datum_feature_material_condition_property are the following:

— applied_to;

— datum_system_conditions_definition;

— name.

4.2.189.1 applied_to

The applied_to specifies the Datum_feature_usage_in_datum_system_relationship (see 5.2.4.391) that identifies the usage of a Datum_feature (see 4.2.188) in a Datum_system (see 5.2.4.316) and to which the material condition property is applied.

4.2.189.2 datum_system_conditions_definition

The datum_system_conditions_definition is an inverse relationship that specifies that the existence of the Datum_feature_material_condition_property depends on the existence of the Datum_system_defining_conditions_with_material_conditions (see 5.2.4.407) that specifies the Datum_feature_material_condition_property as its applied_material_condition_properties.

4.2.189.3 name

The name specifies the type of the applied material condition property, either "least_material_requirement" or "maximum_material_principle" for the Datum_feature_material_condition_property.

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NOTE 1 The application of the maximum material principle to a Datum (see 4.2.176) feature is described in 4.3 ISO 2692.

NOTE 2 The application of the least material requirement to a Datum feature is described in clause 3 of ISO 2692-Amendment 1.

4.2.190 Datum_feature_usage_in_common_datum_relationship

A Datum_feature_usage_in_common_datum_relationship is a type of Datum_feature_usage_in_datum_-relationship (see 5.2.4.132) that associates a Datum_feature (see 4.2.188) with a Common_datum (see 4.2.81) that the Datum_feature participates in establishing.

The data associated with a Datum_feature_usage_in_common_datum_relationship are the following:

— relating_shape_element.

4.2.190.1 relating_shape_element

The relating_shape_element specifies the Common_datum (see 4.2.81) that the Datum_feature (see 4.2.188) specified as the related_shape_element participates in establishing for the Datum_feature_usage_in_common_datum_relationship.

NOTE The attribute related_shape_element is declared in the Datum_feature_usage_in_datum_relationship (see 5.2.4.132) entity of which this entity is a subtype.

4.2.191 Datum_feature_usage_in_datum_relationship

A Datum_feature_usage_in_datum_relationship is a type of Shape_element_relationship (see 5.2.4.169) that associates a Datum_feature (see 4.2.188) with a Datum (see 4.2.176) that the Datum_feature participates in establishing. A Datum_feature_usage_in_datum_relationship is either a Datum_feature_usage_in_common_datum_relationship (see 5.2.4.384) or a Datum_feature_usage_in_single_datum_relationship (see 5.2.4.228).

The data associated with a Datum_feature_usage_in_datum_relationship are the following:

— related_shape_element;

— relating_shape_element.

4.2.191.1 related_shape_element

The related_shape_element specifies the Datum_feature (see 4.2.188) that is used to establish the Datum (see 4.2.176) specified as the relating_shape_element for the Datum_feature_usage_in_datum_relationship.

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4.2.191.2 relating_shape_element

The relating_shape_element specifies the Datum (see 4.2.176) that the specified Datum_feature (see 4.2.188) participates in establishing for the Datum_feature_usage_in_datum_relationship.

Constraints:

UR1: The combination of relating_shape_element and related_shape_element shall be unique within a population of Datum_feature_usage_in_datum_relationship. That is, a specific Datum_feature shall not be used more than once to establish a specific Datum.

4.2.192 Datum_feature_usage_in_datum_system_relationship

A Datum_feature_usage_in_datum_system_relationship is a type of Managed_design_object (see 4.2.431). A Datum_feature_usage_in_datum_system_relationship is a relationship that associates a Datum_feature (see 4.2.188) with a Datum_system (see 5.2.4.316) that the Datum_feature participates in establishing.

The data associated with a Datum_feature_usage_in_datum_system_relationship are the following:

— applied_material_condition_property;

— established_datum_system;

— used_datum_feature.

4.2.192.1 applied_material_condition_property

The applied_material_condition_property is an inverse relationship that specifies that the existence of the Datum_feature_usage_in_datum_system_relationship depends on the existence of the Datum_feature_material_condition_property (see 5.2.4.368) that specifies the Datum_feature_usage_in_datum_system_relationship as its applied_to.

4.2.192.2 established_datum_system

The established_datum_system specifies the Datum_system (see 5.2.4.316) in which the specified Datum_feature (see 4.2.188) participates in establishing for the Datum_feature_usage_in_datum_system_relationship.

4.2.192.3 used_datum_feature

The used_datum_feature specifies the Datum_feature (see 4.2.188) that is used to establish the specified Datum_system (see 5.2.4.316) for the Datum_feature_usage_in_datum_system_relationship.

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Constraints:

WR1: The Datum_feature specified by the used_datum_feature shall establish a Datum that participates in the establishment of the Datum_system specified as the established_datum_system.

4.2.193 Datum_feature_usage_in_single_datum_relationship

A Datum_feature_usage_in_single_datum_relationship is a type of Datum_feature_usage_in_datum_-relationship (see 5.2.4.132) that associates a Datum_feature (see 4.2.188) with the Single_datum (see 5.2.4.130) that the Datum_feature establishes.

The data associated with a Datum_feature_usage_in_single_datum_relationship are the following:

— relating_shape_element.

4.2.193.1 relating_shape_element

The relating_shape_element specifies the Single_datum (see 5.2.4.130) that the Datum_feature (see 4.2.188) specified as the related_shape_element establishes for the Datum_feature_usage_in_single_-datum_relationship.

NOTE The attribute related_shape_element is declared in the Datum_feature_usage_in_datum_relationship entity of which this entity is a subtype.

4.2.194 Datum_plane

A Datum_plane is a type of Datum (see 4.2.176) that is a theoretically exact plane to which toleranced Shape_element (see 4.2.645) are related.

Constraints:

WR1: If the Datum_plane is not specified as a reference_planes of a Datum_reference_frame then the Datum_plane shall be either a Common_datum, or a Single_datum.

WR2: A Datum_plane shall be specified as the vector_of by at most two Datum_based_direction_-vector.

WR3: If the Datum_plane is specified as the vector_of by two Datum_based_direction_vector, the two Datum_based_direction_vector shall specify different values for the positive_direction_vector.

4.2.195 Datum_point

A Datum_point is a type of Datum (see 4.2.176) that is a theoretically exact point to which toleranced Shape_element (see 4.2.645) are related.

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Constraints:

WR1: If the Datum_point is not specified as a reference_origin of a Datum_reference_frame then the Datum_point shall be either a Common_datum, or a Single_datum.

4.2.196 Datum_precedence_assignment

A Datum_precedence_assignment is a type of Managed_design_object (see 4.2.431). A Datum_precedence_assignment is a specification that defines the order in which a Datum (see 4.2.176) is used to establish a Datum_system (see 5.2.4.316).

NOTE Datum systems established by a sequence of datums is discussed in 6.2.3 of ISO 5459.

The data associated with a Datum_precedence_assignment are the following:

— assigned_to;

— datum_system_conditions_definition;

— name.

4.2.196.1 assigned_to

The assigned_to specifies the Datum_usage_in_datum_system_relationship (see 5.2.4.300) that associates a Datum_system (see 5.2.4.316) with the Datum (see 4.2.176) to which the precedence in establishing the Datum_system is assigned by the Datum_precedence_assignment.

4.2.196.2 datum_system_conditions_definition

The datum_system_conditions_definition is an inverse relationship that specifies that the existence of the Datum_precedence_assignment depends on the existence of the Datum_system_defining_conditions (see 5.2.4.301) that specifies the Datum_precedence_assignment as its assigned_datum_precedences.

4.2.196.3 name

The name specifies the label that corresponds to the Datum_precedence_assignment of the specified usage of a Datum (see 4.2.176) in a Datum_system (see 5.2.4.316). The name shall be "primary", "secondary", or "tertiary".

EXAMPLE 1 The requirements may be such that Datum A is assigned as the primary Datum when it is used in one Datum_system. However, additional requirements may be such that Datum A is assigned as the tertiary Datum when it is used in a second Datum_system.

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Constraints:

UR1: The combination of name and datum_system_conditions_definition shall be unique within a population of Datum_precedence_assignment. That is, the defining conditions of a Datum_system shall be such that no two Datum of the Datum_system have been assigned the same precedence.

4.2.197 Datum_reference_frame

A Datum_reference_frame is a type of Non_feature_shape_element (see 5.2.4.127) that is a system of Datum (see 4.2.176) that serve as a frame of reference by which toleranced Shape_element (see 4.2.645) may be located and oriented. The Datum_reference_frame is established by one or more Datum_system (see 5.2.4.316). The Datum_reference_frame consists of three mutually perpendicular Datum_plane (see 5.2.4.129), three mutually perpendicular Datum_axis (see 4.2.177), and a Datum_point (see 5.2.4.128). Each of the Datum_axis is located at the intersections of each unique pair of Datum_plane. The Datum_point is the origin of the Datum_reference_frame and is located at the mutual intersection of the three Datum_plane and three Datum_axis. Only those Datum of a Datum_reference_frame that are also Datum of a Datum_system or from which dimensions are based need to be specified for a Datum_reference_frame.

The data associated with a Datum_reference_frame are the following:

— reference_axes;

— reference_origin;

— reference_planes;

— used_datum_systems.

4.2.197.1 reference_axes

The reference_axes specifies the Datum_axis (see 4.2.177) that are part of the Datum_reference_frame. There shall be at most three Datum_axis specified for a Datum_reference_frame.

4.2.197.2 reference_origin

The reference_origin specifies the Datum_point (see 5.2.4.128) that corresponds to the origin of the Datum_reference_frame. The reference_origin need not be specified for a particular Datum_reference_frame.

4.2.197.3 reference_planes

The reference_planes specify the Datum_plane (see 5.2.4.129) that are part of the Datum_reference_frame. There shall be at most three Datum_plane specified for a Datum_reference_frame.

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4.2.197.4 used_datum_systems

The used_datum_systems is an inverse relationship that specifies that the existence of the Datum_reference_frame is dependent on the existence of the Datum_system (see 5.2.4.316) that specifies the Datum_reference_frame as its established_datum_reference_frame. There shall be one or more Datum_system for the Datum_reference_frame.

Constraints:

WR1: Each of the reference_axes shall be specified to be either be a constituent of, or normal to each of the reference_planes.

WR2: Each Datum_reference_frame shall specify at least one reference_axes, reference_origin, or reference_planes.

4.2.198 Datum_system

A Datum_system is a type of Non_feature_shape_element (see 5.2.4.127) that is a system of Datum (see 4.2.176) that establish a Datum_reference_frame (see 5.2.4.302) by which toleranced Shape_element (see 4.2.645) may be located and oriented.

EXAMPLE 1 Figure 5.2.4.303 illustrates a Datum_system.

NOTE The definition of datum-system is given in 3.2 of ISO 5459.

The data associated with a Datum_system are the following:

— datum_usages;

— defining_conditions;

— established_datum_reference_frame.

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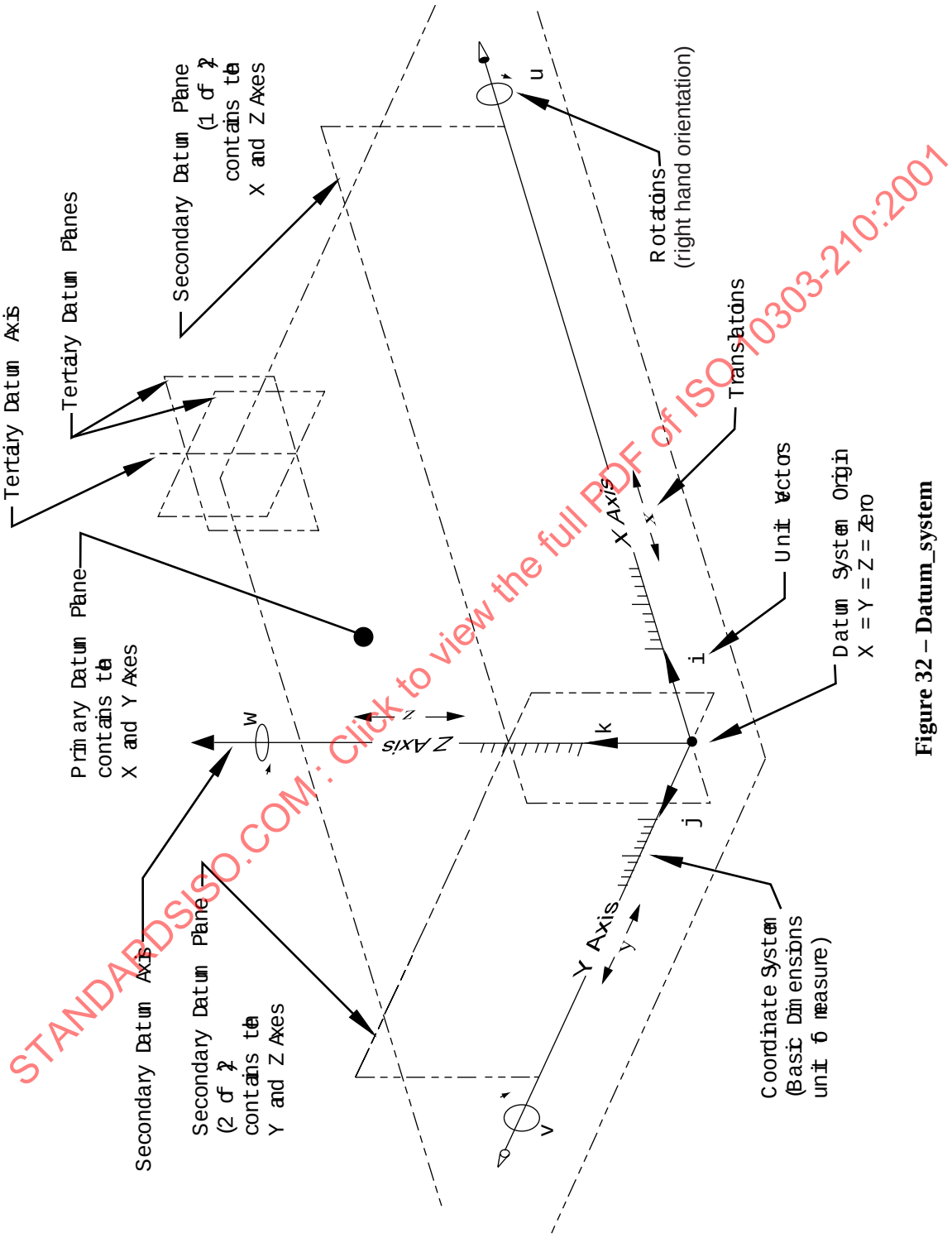

Figure 32 – Datum_system

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4.2.198.1 datum_usages

The datum_usages is an inverse relationship that specifies that the existence of the Datum_system is dependent on the existence of the Datum_usage_in_datum_system_relationship (see 5.2.4.300) that specifies the Datum_system as its established_datum_system. There shall be one, two, or three Datum_usage_in_datum_system_relationship for the Datum_system.

4.2.198.2 defining_conditions

The defining_conditions is an inverse relationship that specifies that the existence of the Datum_system is dependent on the existence of the Datum_system_defining_conditions (see 5.2.4.301) that specifies the Datum_system as its conditions_of.

4.2.198.3 established_datum_reference_frame

The established_datum_reference_frame specifies the Datum_reference_frame (see 5.2.4.302) that is established by the Datum_system.

Constraints:

WR1: Any particular Datum_feature shall be used no more than one time to establish the Datum_system.

WR2: Any particular Datum_target shall be used no more than one time to establish the Datum_system.

4.2.199 Datum_system_defining_conditions

A Datum_system_defining_conditions is a type of Managed_design_object (see 4.2.431). A Datum_system_defining_conditions is either a Datum_system_defining_conditions_without_material_conditions (see 5.2.4.25) or a Datum_system_defining_conditions_with_material_conditions (see 5.2.4.407). A Datum_system_defining_conditions is the specification of the conditions under which a Datum_system (see 5.2.4.316) is established. The conditions include the order in which the Datum (see 4.2.176) are established within the Datum_system and any material condition properties that are explicitly applied to Datum_feature (see 4.2.188) that participate in the establishment of the Datum_system.

The data associated with a Datum_system_defining_conditions are the following:

— assigned_datum_precedences;

— conditions_of.

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4.2.199.1 assigned_datum_precedences

The assigned_datum_precedences specify the Datum_precedence_assignment (see 5.2.4.299) that define the order in which the Datum (see 4.2.176) are established in the Datum_system (see 5.2.4.316) specified as the conditions_of for the Datum_system_defining_conditions. There shall be one, two, or three Datum_precedence_assignment for the Datum_system_defining_conditions.

4.2.199.2 conditions_of

The conditions_of specifies the role of the Datum_system (see 5.2.4.316) for which the Datum_system_defining_conditions are defined.

Constraints:

WR1: The conditions_of the Datum_system_defining_conditions shall be the same instance of Datum_system as specified by the established_datum_system attribute of the Datum_usage_in_datum_system_relationship that is specified by the assigned_to attribute of the Datum_precedence_assignment specified by the assigned_datum_precedences. That is, the Datum_system_defining_conditions and the specified Datum_precedence_assignments must be associated with the same Datum_system.

WR2: The name tertiary shall not exist in the names of the assigned_datum_precedences unless the name secondary exists in the names of the assigned_datum_precedences.

WR3: The name secondary shall not exist in the names of the assigned_datum_precedences unless the name primary exists in the names of the assigned_datum_precedences.

WR4: The datum_system_defining_conditions shall be referenced by at least one Geometric_tolerance_with_referenced_datum_system or Dimension_location_with_specified_datum_system.

4.2.200 Datum_system_defining_conditions_with_material_conditions

A Datum_system_defining_conditions_with_material_conditions is a type of Datum_system_defining_conditions (see 5.2.4.301) that specifies the conditions under which a Datum_system (see 5.2.4.316) is established and in which either the "least_material_requirement" or the "maximum_material_principle" has been applied to usages of one or more Datum_feature (see 4.2.188) in the Datum_system.

NOTE If neither the "least_material_requirement" nor the "maximum_material_principle" is explicitly applied and the Datum_feature is a feature of size, the principle that is termed "regardless of feature size" in ASME Y14.5M is assumed to be in effect.

The data associated with a Datum_system_defining_conditions_with_material_conditions are the following:

— applied_material_condition_properties.

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4.2.200.1 applied_material_condition_properties

The applied_material_condition_properties specify the Datum_feature_material_condition_property (see 5.2.4.368) that define the material condition properties that are explicitly applied to the Datum_feature (see 4.2.188) in the context of the Datum_system (see 5.2.4.316) for the Datum_system_defining_conditions_with_material_conditions. There shall be one or more Datum_feature_material_condition_property for a Datum_system_defining_conditions_with_material_conditions.

EXAMPLE 1 The requirements may be such that the "maximum material principle" applies to Datum_feature A when it is used in one Datum_system. However, additional requirements may be such that neither the "maximum material principle" nor the "least material requirement" applies to Datum_feature A when it is used in a second Datum_system.

Constraints:

WR1: The conditions_of the Datum_system_defining_conditions_with_material_conditions shall be the same instance of Datum_system as specified by the established_datum_system attribute of the Datum_feature_usage_in_datum_system_relationship that is specified by the applied_to attribute of the Datum_feature_material_condition_property specified by the applied_material_condition_properties. That is, the Datum_system_defining_conditions_with_material_conditions and the specified Datum_feature_material_condition_propertys shall be associated with the same Datum_system.

4.2.201 Datum_system_defining_conditions_without_material_conditions

A Datum_system_defining_conditions_without_material_conditions is a type of Datum_system_defining_conditions (see 5.2.4.301) that specifies the conditions under which a Datum_system (see 5.2.4.316) is established and in which neither the "least material requirement" nor the "maximum material principle" have been applied to any of the Datum_feature (see 4.2.188) used to establish the Datum_system.

4.2.202 Datum_target

A Datum_target is a type of Physical_feature_or_part_template (see 4.2.527) that is used to define one or more Datum_target_set (see 5.2.4.338).

NOTE 1 Typically datum targets are used when it is not appropriate to specify an entire surface as a Datum_feature (see 4.2.188).

NOTE 2 The definition of datum target is given in 3.4 of ISO 5459.

The data associated with a Datum_target are the following:

— datum_target_usages.

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4.2.202.1 datum_target_usages

The datum_target_usages is an inverse relationship that specifies that the existence of the Datum_target is dependent on the existence of the Datum_target_usage_in_datum_target_set_relationship (see 5.2.4.67) that specifies the Datum_target as its used_datum_target. There shall be one or more Datum_target_usage_in_datum_target_set_relationship for the Datum_target.

4.2.203 Datum_target_set

A Datum_target_set is a type of Datum_feature (see 4.2.188) that is composed of one or more Datum_target (see 5.2.4.66).

The data associated with a Datum_target_set are the following:

— included_datum_targets.

4.2.203.1 included_datum_targets

The included_datum_targets is an inverse relationship that specifies that the existence of the Datum_target_set is dependent on the existence of the Datum_target_usage_in_datum_target_set_relationship (see 5.2.4.67) that specifies the Datum_target_set as its defined_datum_target_set. There shall be one or more Datum_target_usage_in_datum_target_set_relationship for the Datum_target_set.

Constraints:

WR1: A Datum_target_set shall not participate as a related_shape_element in a Shape_element_constituent_relationship. That is, a Datum_target_set shall not be a constituent of another Shape_element.

4.2.204 Datum_target_usage_in_datum_target_set_relationship

Datum_target_usage_in_datum_target_set_relationship is a type of Managed_design_object (see 4.2.431). A Datum_target_usage_in_datum_target_set_relationship is a relationship that associates a Datum_target (see 5.2.4.66) with a Datum_target_set (see 5.2.4.338) that the Datum_target participates in defining.

The data associated with a Datum_target_usage_in_datum_target_set_relationship are the following:

— datum_target_number;

— defined_datum_target_set;

— used_datum_target.

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4.2.204.1 datum_target_number

The datum_target_number specifies the positive integer that identifies the usage of the Datum_target (see 5.2.4.66) in the definition of a Datum_target_set (see 5.2.4.338) for the Datum_target_usage_in_datum_-target_set_relationship.

NOTE The datum target number is described in 7.1.1 of ISO 5459.

4.2.204.2 defined_datum_target_set

The defined_datum_target_set specifies the Datum_target_set (see 5.2.4.338) in which the specified Datum_target (see 5.2.4.66) participates in defining.

4.2.204.3 used_datum_target

The used_datum_target specifies the Datum_target (see 5.2.4.66) that is used to define the Datum_-target_set (see 5.2.4.338) specified as the defined_datum_target_set for the Datum_target_usage_in_-datum_target_set_relationship.

NOTE Since a Datum_target may be used to define multiple Datum_target_sets and the Datum_target number may be different depending on the Datum_target_set that the Datum_target participates in defining, the Datum_target_number is assigned to the Datum_target_usage_in_datum_target_set_relationship rather than on the Datum_-target.

EXAMPLE 1 A datum target is used to define datum target sets A and G. The usage of the datum target in the definition of datum target set A is assigned a datum target number of 3. The usage of the datum target in defining datum target set G is assigned a datum target number of 1. This situation would be represented by a single instance of Datum_target, two instances of Datum_target_set, and two instances of Datum_target_usage_in_datum_target_-set_relationship. The instances of Datum_target_set would be assigned the identifications of "A" and "G". The instances of Datum_target_usage_in_datum_target_set_relationship that associate the instance of Datum_target to the instances of Datum_target_set identified as "A" and "G" would have datum_target_number values of 3 and 1, respectively.

Constraints:

UR1: The combination of used_datum_target and defined_datum_target_set shall be unique within a population of Datum_target_usage_in_datum_target_set_relationship. That is, a specific Datum_target shall not be used more than once to define a specific Datum_feature.

UR2: The combination of datum_target_number and defined_datum_target_set shall be unique within a population of Datum_target_usage_in_datum_target_set_relationship.

4.2.205 Datum_usage_in_datum_system_relationship

A Datum_usage_in_datum_system_relationship is a type of Managed_design_object (see 4.2.431). A Datum_usage_in_datum_system_relationship is a relationship that associates a Datum_system (see 5.2.4.316) with a Datum (see 4.2.176) that participates in establishing the Datum_system.

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The data associated with a Datum_usage_in_datum_system_relationship are the following:

— established_datum_system;

— precedence_assignment;

— used_datum.

4.2.205.1 established_datum_system

The established_datum_system specifies the Datum_system (see 5.2.4.316) that the Datum (see 4.2.176) specified as the used_datum participates in establishing for the Datum_usage_in_datum_system_relationship.

4.2.205.2 precedence_assignment

The precedence_assignment is an inverse relationship that specifies that the existence of the Datum_usage_in_datum_system_relationship is dependent on the existence of the Datum_precedence_assignment (see 5.2.4.299) that specifies the Datum_usage_in_datum_system_relationship as its assigned_to.

4.2.205.3 used_datum

The used_datum specifies the Datum (see 4.2.176) that is used to establish the Datum_system (see 5.2.4.316) specified as the established_datum_system for the Datum_usage_in_datum_system_relationship.

Constraints:

UR1: The combination of used_datum and established_datum_system shall be unique within a population of Datum_usage_in_datum_system_relationship. That is, a specific Datum shall not be used more than once to establish a specific Datum_system.

WR1: The Datum specified as the used_datum shall either be a Common_datum or a Single_datum.

IP1: The Datum specified as the used_datum shall either be a constituent Datum of the Datum_reference_frame established by the Datum_system specified by the established_datum_system, or it shall be dimensioned from one or more constituent Datum of the established Datum_reference_frame.

4.2.206 Default_assembly_bond_shape

A Default_assembly_bond_shape is a type of Managed_design_object (see 4.2.431). A Default_assembly_bond_shape is the shape of an Assembly_bond_definition (see 4.2.26).

The data associated with a Default_assembly_bond_shape are the following:

— characterized_bond_definition.

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4.2.206.1 characterized_bond_definition

The characterized_bond_definition specifies the role of the Assembly_bond_definition (see 4.2.26) for the Default_assembly_bond_shape.

4.2.207 Default_attachment_size_and_component_termination_passage_based_land_-physical_template

A Default_attachment_size_and_component_termination_passage_based_land_physical_template is a type of Default_attachment_size_based_land_physical_template (see 5.2.4.118) and of Default_component_-termination_passage_based_land_physical_template (see 5.2.4.166). The shape of this template is dependent on both the requirements from the passage definition and the requirement for support of the interface between the instance of the Part_terminal (see 4.2.502) intended to mate with an instance of the Land_physical_template (see 5.2.4.85).

4.2.208 Default_attachment_size_and_via_based_land_physical_template

A Default_attachment_size_and_via_based_land_physical_template is a type of Default_attachment_-size_based_land_physical_template (see 5.2.4.118) and of Default_via_based_land_physical_template (see 5.2.4.88). This template shape is dependent on both the requirement from the Default_via_definition (see 5.2.4.89) and the shape of the related Part_terminal (see 4.2.502).

4.2.209 Default_attachment_size_based_land_physical_template

A Default_attachment_size_based_land_physical_template is a type of Default_land_physical_template (see 5.2.4.95). A Default_attachment_size_based_land_physical_template may be a Default_attachment_size_and_component_termination_passage_based_land_physical_template (see 5.2.4.378) or a Default_attachment_size_and_via_based_land_physical_template (see 5.2.4.86). This template shape is dependent only on the shape of the Part_terminal (see 4.2.502) it is intended to mate with.

The data associated with a Default_attachment_size_based_land_physical_template are the following:

— minimum_attachment_region_size;

— maximum_attachment_region_size.

4.2.209.1 minimum_attachment_region_size

The minimum_attachment_region_size specifies one of the roles of the Connection_zone for the Default_attachment_size_based_land_physical_template. The minimum_attachment_region_size specifies the smallest Connection_zone for the Default_attachment_size_based_land_physical_template.

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4.2.209.2 maximum_attachment_region_size

The maximum_attachment_region_size specifies one of the roles of the Connection_zone for the Default_attachment_size_based_land_physical_template. The maximum_attachment_region_size specifies the largest Connection_zone for the Default_attachment_size_based_land_physical_template.

4.2.210 Default_component_termination_passage_based_land_physical_template

A Default_component_termination_passage_based_land_physical_template is a type of Default_passage_based_land_physical_template (see 5.2.4.96). A Default_component_termination_passage_based_land_physical_template may be a Default_attachment_size_and_component_termination_passage_based_land_physical_template (see 5.2.4.378). The shape of the land template is dependent upon the requirements from Passage_technology (see 4.2.509).

The data associated with a Default_component_termination_passage_based_land_physical_template are the following:

— of_passage_technology.

4.2.210.1 of_passage_technology

The of_passage_technology specifies the role of the Default_component_termination_passage_definition (see 5.2.4.111) for the Default_component_termination_passage_based_land_physical_template.

4.2.211 Default_component_termination_passage_definition

A Default_component_termination_passage_definition is a type of Passage_technology (see 4.2.509) that defines a default passage based on characteristics of the associated Part_terminal (see 4.2.502).

The data associated with a Default_component_termination_passage_definition are the following:

— deposition_material;

— maximum_allowed_component_terminal_extent;

— minimum_allowed_component_terminal_extent;

— minimum_as_finished_deposition_thickness;

— minimum_as_finished_passage_extent.

4.2.211.1 deposition_material

The deposition_material specifies the role of the Ee_material (see 4.2.273) for the Default_component_termination_passage_definition.

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4.2.211.2 maximum_allowed_component_terminal_extent

The maximum_allowed_component_terminal_extent specifies one role of the Length_data_element (see 4.2.422) for the Default_component_termination_passage_definition.

4.2.211.3 minimum_allowed_component_terminal_extent

The minimum_allowed_component_terminal_extent specifies one role of the Length_data_element (see 4.2.422) for the Default_component_termination_passage_definition.

4.2.211.4 minimum_as_finished_deposition_thickness

The minimum_as_finished_deposition_thickness specifies one role of the Length_data_element (see 4.2.422) for the Default_component_termination_passage_definition.

4.2.211.5 minimum_as_finished_passage_extent

The minimum_as_finished_passage_extent specifies one role of the Length_data_element (see 4.2.422) for the Default_component_termination_passage_definition.

Constraints:

WR1: The passage deposition material shall be conductive.

4.2.212 Default_land_physical_template

A Default_land_physical_template is a type of Land_physical_template (see 5.2.4.85). A Default_land_physical_template is either a Default_passage_based_land_physical_template (see 5.2.4.96) or a Default_attachment_size_based_land_physical_template (see 5.2.4.118).

The data associated with a Default_land_physical_template are the following:

— of_stratum_technology.

4.2.212.1 of_stratum_technology

The of_stratum_technology specifies the role of the Stratum_technology (see 4.2.702) for the Default_land_physical_template.

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4.2.213 Default_passage_based_land_physical_template

A Default_passage_based_land_physical_template is a type of Default_land_physical_template (see 5.2.4.95). A Default_passage_based_land_physical_template is either a Default_component_termination_passage_-based_land_physical_template (see 5.2.4.166), a Default_unsupported_passage_based_land_physical_-template (see 5.2.4.97), or a Default_via_based_land_physical_template (see 5.2.4.88). The shape of a Land (see 4.2.407) based on this template is dependent on the shape of the passage with which it is associated.

EXAMPLE 1 Figure 5.2.4.98 illustrates the relationship between the minimum_annular_ring and the size category of finished hole for which the minimum_annular_ring is defined. The category information is specified in the member of Passage_technology (see 4.2.509) associated with this Default_passage_based_land_physical_template.

NOTE The usual domain technical reference is ANSI/IPC D-275.

The data associated with a Default_passage_based_land_physical_template are the following:

— minimum_annular_ring;

— minimum_fabrication_allowance;

— of_passage_technology.

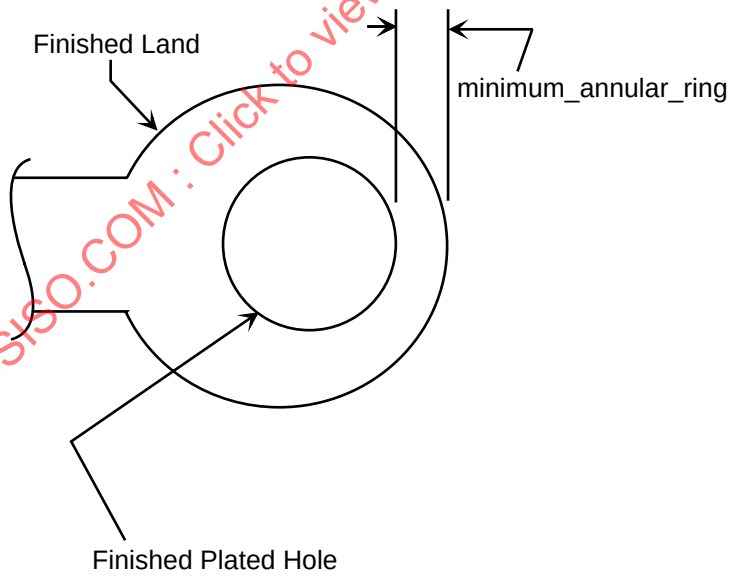

Figure 33 – Measurement arrangement for minimum_annular_ring

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4.2.213.1 minimum_annular_ring

The minimum_annular_ring specifies the Length_data_element (see 4.2.422) of the smallest dimension between each point on the inner bound of a passage and the nearest point on the outer bound of a Land (see 4.2.407) containing the passage for the Default_passage_based_land_physical_template.

4.2.213.2 minimum_fabrication_allowance

The minimum_fabrication_allowance specifies the Length_data_element (see 4.2.422) for the smallest dimension of the total of the manufacturing process tolerance effects for the Default_passage_based_-land_physical_template.

4.2.213.3 of_passage_technology

The of_passage_technology specifies the role of the Passage_technology (see 4.2.509) for the Default_-passage_based_land_physical_template.

Constraints:

UR1: The combination of the attribute of_passage_technology and the attribute of_stratum_technology inherited from the supertype Default_land_physical_template shall be unique in a population of Default_passage_based_land_physical_template.

4.2.214 Default_trace_template

A Default_trace_template is a type of Trace_template (see 5.2.4.29). The Default_trace_template is associated with a particular Stratum_technology (see 4.2.702), to allow verification that the design of the trace template meets the relevant minimum and maximum guidelines of that Stratum_technology.

The data associated with a Default_trace_template are the following:

— of_stratum_technology.

4.2.214.1 of_stratum_technology

The of_stratum_technology specifies the role of the Stratum_technology (see 4.2.702) for the Default_-trace_template.

4.2.215 Default_unsupported_passage_based_land_physical_template

A Default_unsupported_passage_based_land_physical_template is a type of Default_passage_based_-land_physical_template (see 5.2.4.96) where the passage type is a passage that has no metallized support.

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The data associated with a Default_unsupported_passage_based_land_physical_template are the following:

— of_passage_technology.

4.2.215.1 of_passage_technology

The of_passage_technology specifies the role of the Default_unsupported_passage_definition (see 5.2.4.148) for the Default_unsupported_passage_based_land_physical_template.

4.2.216 Default_unsupported_passage_definition

A Default_unsupported_passage_definition is a type of Passage_technology (see 4.2.509) where the passage is unsupported by metallization.

The data associated with a Default_unsupported_passage_definition are the following:

— minimum_as_finished_passage_definition.

4.2.216.1 minimum_as_finished_passage_definition

The minimum_as_finished_passage_definition specifies one role of the Length_data_element (see 4.2.422) for the Default_via_definition (see 5.2.4.89).

4.2.217 Default_via_based_land_physical_template

A Default_via_based_land_physical_template is a type of Default_passage_based_land_physical_template (see 5.2.4.96) where the passage type is a Via (see 4.2.761). A Default_via_based_land_physical_-template may be a Default_attachment_size_and_via_based_land_physical_template (see 5.2.4.86).

The data associated with a Default_via_based_land_physical_template are the following:

— of_passage_technology.

4.2.217.1 of_passage_technology

The of_passage_technology specifies the role of the Default_via_definition (see 5.2.4.89) for the Default_via_based_land_physical_template.

4.2.218 Default_via_definition

A Default_via_definition is a type of Passage_technology (see 4.2.509) that defines the default shape of the Via (see 4.2.761).

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The data associated with a Default_via_definition are the following:

— deposition_material;

— minimum_as_finished_deposition_thickness;

— minimum_as_finished_passage_extent.

4.2.218.1 deposition_material

The deposition_material specifies the role of the Ee_material (see 4.2.273) in the Via (see 4.2.761) for the Default_via_definition.

4.2.218.2 minimum_as_finished_deposition_thickness

The minimum_as_finished_deposition_thickness specifies the Length_data_element (see 4.2.422) that is the lower bound for the thickness of the deposited Ee_material (see 4.2.273) for the Default_via_-definition.

4.2.218.3 minimum_as_finished_passage_extent

The minimum_as_finished_passage_extent specifies one role of the Length_data_element (see 4.2.422) for the Default_via_definition.

Constraints:

WR1: The passage deposition material shall be conductive.

4.2.219 Delete_design_object_management_relationship

A Delete_design_object_management_relationship is a type of Design_object_management_relationship (see 4.2.238). Together with Change_design_object_management_relationship and Add_design_-object_management_relationship, Delete_design_object_management_relationship supports the exchange of changes to a design by the use of a data set containing only (1) the information necessary to identify the design (e.g., an Ee_product_definition or an Ee_product_version), which is assumed to be already known to the receiving system, and (2) the design objects that have been added, changed, or deleted.

NOTE Note that all the quality and structural requirements defined in this part of ISO 10303 also apply to the resultant new design iteration.

The data associated with a Delete_design_object_management_relationship are the following:

— previous_design_object.

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4.2.219.1 previous_design_object

The previous_design_object specifies the role of the Managed_design_object (see 4.2.431) for the Delete_-design_object_management_relationship.

Constraints:

UR1: The combination of the previous_design_object and the previous_design inherited from Design_-object_management_relationship shall be unique within a population of Delete_design_object_manage-ment_relationships.

4.2.220 Dependently_located_layer_connection_point

A Dependently_located_layer_connection_point is a type of Layer_connection_point (see 5.2.4.420) that is position dependent on the location of an Interconnect_module_terminal (see 5.2.4.211) or an Inter_-stratum_feature (see 4.2.364).

NOTE This part of ISO 10303 provides the capability to support one interconnect design for multiple assembly designs where components at the assembly level may or may not exist for any or all of the multiple assembly designs.

EXAMPLE 1 An example of an Dependently_located_layer_connection_point is the case where a common in-terconnect must be supplied for several assemblies. A specific microcircuit device, such as "U32" may be supplied for one or more, but not all, of the assemblies, but the interconnect must be identical.

EXAMPLE 2 Figure 5.2.4.58 illustrates a detail of a layout drawing that shows the relationship of two members of Dependently_located_layer_connection_point and the associated Conductor (see 5.2.4.162).

The data associated with a Dependently_located_layer_connection_point are the following:

— associated_design_object.

4.2.220.1 associated_design_object

The associated_design_object specifies either the role of an Interconnect_module_terminal (see 5.2.4.211) or the role of an Inter_stratum_feature (see 4.2.364) for the Dependently_located_layer_connection_-point.

Constraints:

UR1: The combination of the attribute associated_design_object and the attribute resident_design_-layer_stratum inherited from the supertype Layer_connection_point shall be unique in a population of Dependently_located_layer_connection_point.

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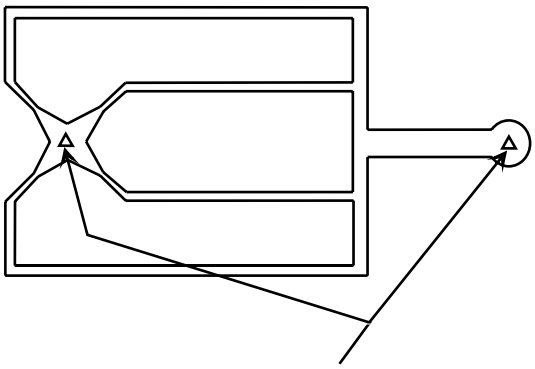

Figure 34 – Dependently_located_layer_connection_point

IP1: The Layer_connection_point is constrained to be within the material volume specified by the associated_design_object.

4.2.221 Derived_shape_element

A Derived_shape_element is a type of Non_feature_shape_element (see 5.2.4.127) that is derived from a set of one or more other Shape_element (see 4.2.645). A Derived_shape_element is one of an Apex (see 4.2.21), a Centre_of_symmetry (see 4.2.70), a Geometric_alignment (see 5.2.4.278), a Geometric_intersection (see 5.2.4.279), a Linear_extension (see 5.2.4.296), or a Tangent_shape_element (see 5.2.4.297).

The data associated with a Derived_shape_element are the following:

— deriving_relationships.

4.2.221.1 deriving_relationships

The deriving_relationships is an inverse relationship that specifies that the existence of the Derived_shape_element is dependent on the existence of the Shape_element_deriving_relationship (see 4.2.649) that specifies the Derived_shape_element as its relating_shape_element. There shall be one or more Shape_element_deriving_relationship specified as the deriving_relationships for a Derived_shape_element.

EXAMPLE 1 The Centre_axis (see 4.2.69) of a cylindrical hole is a Derived_shape_element. The Centre_axis cannot exist unless the hole exists.

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Constraints:

WR1: A Derived_shape_element shall not be derived from itself, either directly or through intermediate Derived_shape_elements.

4.2.222 Design_characteristic_occurrence

A Design_characteristic_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that specifies the technical performance values and tolerances for some aspect of a design.

NOTE The specifications set forth in Design_characteristics may include such items as enterprise or customer specifications on preferred packaging, power design and control, design rules, and preferred design practices.

4.2.223 Design_composition_path

A Design_composition_path is a type of Managed_design_object (see 4.2.431). A Design_composition_path is a collection of Functional_unit (see 5.2.4.313) that together compose one path through the complete functional definition that has the design_functional_unit as a reference to the Functional_unit_definition (see 5.2.4.305) that is the leaf node. The functional definition has a root node that is a Functional_unit_network_definition (see 5.2.4.339). The path is then established by starting at the leaf element and traversing the collection of path_element in the sequence in which they exist in the functional definition between the leaf element and the root element. Each member of path_element establishes a link in the sequence. The Design_composition_path is a mapping source for a packaging application to use to map between a hierarchical description and a flattened description of a network.

NOTE The types of node elements that are composing a directed acyclic graph must be consistent. This part of ISO 10303 uses Functional_unit_definition (see 5.2.4.305) as the node elements.

The data associated with a Design_composition_path are the following:

— design_functional_unit;

— path_element.

4.2.223.1 design_functional_unit

The design_functional_unit specifies the Functional_unit (see 5.2.4.313) for the leaf element for the Design_composition_path.

4.2.223.2 path_element

The path_element specifies the role of the Functional_unit (see 5.2.4.313) for the Design_composition_path. There shall be one or more Functional_unit for a Design_composition_path.

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4.2.224 Design_functional_unit_allocation_to_assembly_component

A Design_functional_unit_allocation_to_assembly_component is a type of Managed_design_object (see 4.2.431). A Design_functional_unit_allocation_to_assembly_component may be a Transmission_line_-functional_unit_to_routed_printed_component_allocation (see 5.2.4.369). A Design_functional_unit_-allocation_to_assembly_component is the relationship between the Design_composition_path (see 4.2.223) and the Assembly_component (see 4.2.27) that performs the required function.

The data associated with a Design_functional_unit_allocation_to_assembly_component are the following:

— functional_design_definition_path;

— global_swappable;

— implementation;

— local_swappable;

— of_property;

— path_alias;

— swap_code.

NOTE Frozen_assignment (see 5.2.4.389) is used to indicate that the Design_functional_unit_allocation_to_-assembly_component relationship is approved and can not be changed during further design activity without additional formal action.

4.2.224.1 functional_design_definition_path

The functional_design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Design_functional_unit_allocation_to_assembly_component.

4.2.224.2 global_swappable

The global_swappable specifies a boolean value that indicates if occurrences of the associated path can be exchanged within the context of an Ee_product being designed.

4.2.224.3 implementation

The implementation specifies the role of the Assembly_component (see 4.2.27) for the Design_functional_unit_allocation_to_assembly_component.

NOTE A Design_functional_unit_allocation_to_assembly_component approval may be indicated by including a complex instance consisting of Design_functional_unit_allocation_to_assembly_component and Frozen_assignment (see 5.2.4.389).

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4.2.224.4 local_swappable

The local_swappable specifies a boolean value that indicates if occurrences of the associated path can be exchanged within the context of an Assembly_component.

4.2.224.5 of_property

The of_property specifies the role of the Coordinated_characteristc for the Design_functional_unit_allocation_to_assembly_component. There may be more than one of_property for a Design_functional_unit_allocation_to_assembly_component. The of_property need not be specified for a particular Design_functional_unit_allocation_to_assembly_component.

4.2.224.6 path_alias

The path_alias specifies the string that is the identifier in the context of the implementation for the Design_functional_unit_allocation_to_assembly_component.

EXAMPLE 1 "A", "B", "C", "D", are typical path_alias for a quad NAND gate part.

4.2.224.7 swap_code

The swap_code specifies the string that is the type of replacement that is valid.

Constraints:

UR1: The combination of implementation and path_alias shall be unique within a population of Design_functional_unit_allocation_to_assembly_component.

4.2.225 Design_functional_unit_allocation_to_assembly_joint

A Design_functional_unit_allocation_to_assembly_joint is a type of Managed_design_object (see 4.2.431). A Design_functional_unit_allocation_to_assembly_joint is an assignment of a Functional_unit (see 5.2.4.313) in a Design_composition_path (see 4.2.223) to its implementation in an Assembly_joint (see 4.2.32).

The data associated with a Design_functional_unit_allocation_to_assembly_joint are the following:

— functional_design_definition_path;

— implementation.

4.2.225.1 functional_design_definition_path

The functional_design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Design_functional_unit_allocation_to_assembly_joint.

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4.2.225.2 implementation

The implementation specifies the role of the Assembly_joint (see 4.2.32) for the Design_functional_-unit_allocation_to_assembly_joint.

NOTE This application object is included to support detailed analysis of product design.

Constraints:

UR1: The functional_design_definition_path shall be unique within a population of Design_functional_-unit_allocation_to_assembly_joint.

4.2.226 Design_functional_unit_allocation_to_fabrication_joint

A Design_functional_unit_allocation_to_fabrication_joint is a type of Managed_design_object (see 4.2.431). A Design_functional_unit_allocation_to_fabrication_joint is an assignment of a Functional_unit (see 5.2.4.313) in a Design_composition_path (see 4.2.223) to its implementation in a Fabrication_joint (see 5.2.4.396).

The data associated with a Design_functional_unit_allocation_to_fabrication_joint are the following:

— functional_design_definition_path;

— implementation.

4.2.226.1 functional_design_definition_path

The functional_design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Design_functional_unit_allocation_to_fabrication_joint.

4.2.226.2 implementation

The implementation specifies the role of the Fabrication_joint (see 5.2.4.396) for the Design_functional_-unit_allocation_to_fabrication_joint.

NOTE This application object is included to support detailed analysis of product design.

Constraints:

UR1: The functional_design_definition_path shall be unique within a population of Design_functional_-unit_allocation_to_fabrication_joint.

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4.2.227 Design_functional_unit_allocation_to_reference_functional_unit

A Design_functional_unit_allocation_to_reference_functional_unit is a type of Managed_design_object (see 4.2.431). A Design_functional_unit_allocation_to_reference_functional_unit is an assignment of a Functional_unit (see 5.2.4.313) in a Design_composition_path (see 4.2.223) to a Functional_unit in a Reference_composition_path (see 5.2.4.402) for the functional definition of a product.

NOTE 1 This provides the capability to exchange a functional decomposition that an enterprise reuses in multiple designs.

NOTE 2 The library functional hierarchy, if provided, is required to be a network definition with the constraint that only external references on the root node of the network structure will be mapped to physical terminals of the reused product design.

NOTE 3 The allocation relationship in this Application Object is critical in mapping between a functional design and a physical implementation of that design, because this part of ISO 10303 relies on the reference mapping between a functional definition in a library and the physical implementation of that functional definition in that library, usually in a packaged part, to identify the necessary definitions that need to be instantiated in the physical design.

The data associated with a Design_functional_unit_allocation_to_reference_functional_unit are the following:

— design_definition_path;

— reference_definition_path.

4.2.227.1 design_definition_path

The design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Design_functional_unit_allocation_to_reference_functional_unit.

4.2.227.2 reference_definition_path

The reference_definition_path specifies the role of the Reference_composition_path (see 5.2.4.402) for the Design_functional_unit_allocation_to_reference_functional_unit.

Constraints:

WR1: The functional_unit_definition that defines the leaf node of the reference_definition_path and the functional_unit_definition that defines the leaf node of the design_definition_path shall be the same definition.

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4.2.228 Design_intent_modification

A Design_intent_modification is a type of Managed_design_object (see 4.2.431). A Design_intent_-modification may be one of Material_addition_feature (see 5.2.4.417), Material_removal_feature (see 5.2.4.418), or Material_shape_modification (see 5.2.4.59). A Design_intent_modification provides capabilities to archive design intent along with constraint based modifications so that if a constraint is removed the original design intent, or a part thereof, may be restored.

EXAMPLE 1 This example shows how this part of ISO 10303 may be used to exchange or archive design intent for the case of a power plane where there is penetration of the power plane by other signals. Figure 5.2.4.194 is the original design intent for Power Plane 1 that is captured in a member of Connected_filled_area (see 5.2.4.153)(#1).

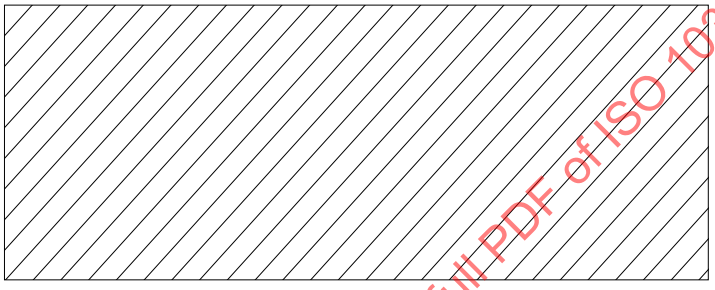

Figure 35 – Power Plane 1 design intent

Figure 5.2.4.195 is the original design intent for Power Plane 2 that is captured in a member of Connected_filled_-area (#2).

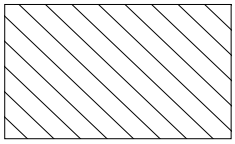

Figure 36 – Power Plane 2 design intent

Figure 5.2.4.197 is the original design intent for Signal (see 5.2.4.198) 3 that is captured in a member of Conductor (see 5.2.4.162)(#3). In order to accomplish the embedding of Power Plane 2 into Power Plane 1 and in order to accomplish the embedding of Signal 3 into the result of the previous embedding, a sequence is followed. In order to meet requirements, constraints must be satisfied regarding spacing of conductive areas. These constraints are specified by the Ee_requirement_occurrence (see 4.2.283). Note that the following method is based on the relative priority of the signal and the two power planes. This example assumes that the conductor has the highest priority for area, followed by Power Plane 2 followed by Power Plane 1 which has the lowest priority.

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Figure 37 – Signal 3 design intent

Step 1: Create three "design intent" Stratum_features as above. Note that these features are a permanent part of the design.

Step 2: Create a member of Material_removal_stratum_feature_template (see figure 5.2.4.238) for the spacing requirement to be met between Power Plane 2 and Power Plane 1. This template shape is dependent on the voltage between Power Plane 2 and Power Plane 1. The distance between the outer extent of Power Plane 2 and the outer extent of the template shape is explicitly stated in the electrical_isolation_spacing_requirement between the Power Plane 2 and Power Plane 1. Populate member of Electrical_isolation_material_removal_structure to capture the stated relationships and properties. For further reference in this example, this member will be called 1.

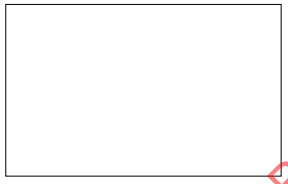

Figure 38 – Power Plane 1 to 2 Material removal template

Step 3: Create a Material_removal_stratum_feature_template (see figure 5.2.4.312) for the spacing requirement to be met between Signal 3 and Power Plane 1. This template shape is dependent on the voltage between Signal 3 and Power Plane 1. The distance between the outer extent of Signal 3 and the outer extent of the template shape is explicitly stated in the electrical_isolation_spacing_requirement between the Signal 3 and Power Plane 1. Populate a member of Electrical_isolation_material_removal_structure to capture the stated relationships and properties. For further reference in the example, this member will be called 2.

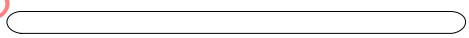

Figure 39 – Power Plane 1 to Signal 3 Material removal template

Step 4: Create a Material_removal_stratum_feature_template (see figure 5.2.4.7) for the spacing requirement to be met between Signal 3 and Power Plane 2. This template shape is dependent on the voltage between Signal 3 and Power Plane 2. The distance between the outer extent of Signal 3 and the outer extent of the template shape is explicitly stated in the electrical_isolation_spacing_requirement between the Signal 3 and Power Plane 2. Populate a member of Electrical_isolation_material_removal_structure to capture the stated relationships and properties. For further reference in the example, this member will be called 3. As a summary at this point, all the design intent shapes are defined; all the electrical isolation shapes are defined.

See figure 5.2.4.15 for the result achieved by a processor in conformance with this part of ISO 10303, in support of a CAD application, or in support of a manufacturing application.

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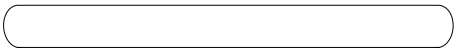

Figure 40 – Power Plane 2 to Signal 3 Material removal template

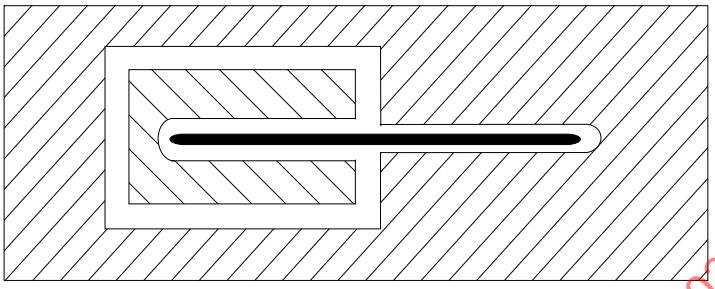

Figure 41 – Final shape for the combined signals

Since Signal 3 has a higher priority than Power Plane 2, the precedent_modification attribute specifies Electrical_isolation_material_removal_structure #1 and the subsequent_modification specifies Electrical_isolation_material_removal_structure #2

The data associated with a Design_intent_modification are the following:

— design_intent;

— modification_causal_item.

4.2.228.1 design_intent

The design_intent specifies the Stratum_feature (see 4.2.683) that is changed by the Design_intent_modification.

4.2.228.2 modification_causal_item

The modification_causal_item specifies one of either an Assembly_component (see 4.2.27), a Component_external_reference (see 4.2.89), a Component_feature (see 4.2.90), or a Component_feature_external_reference (see 4.2.91), or one of an Ee_requirement_occurrence (see 4.2.283), a Stratum (see 4.2.677), or one of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) that is the cause of the Design_intent_modification.

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Constraints:

WR1: A processor reading an exchange file based on this part of ISO 10303 shall interpret the lack of member of Design_intent_modification_sequence as meaning that there are no conflicting members of Electrical_isolation_material_removal_structure in the exchange file, and that they may be applied in any sequence.

4.2.229 Design_intent_modification_3d_shape

A Design_intent_modification_3d_shape is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_3d_shape is the representation of a Design_intent_modification (see 5.2.4.408) by a Bound_volume_shape (see 4.2.58).

The data associated with a Design_intent_modification_3d_shape are the following:

— represented_design_intent_modification;

— shape_representation.

4.2.229.1 represented_design_intent_modification

The represented_design_intent_modification specifies the Design_intent_modification (see 5.2.4.408) that is to be characterized by the Design_intent_modification_3d_shape.

4.2.229.2 shape_representation

The shape_representation specifies the Bound_volume_shape (see 4.2.58) for the representation of the Design_intent_modification (see 5.2.4.408).

4.2.230 Design_intent_modification_in_stratum_3d_position

A Design_intent_modification_in_stratum_3d_position is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_in_stratum_3d_position is the three dimensional position and orientation of a three dimensional model of a Design_intent_modification (see 5.2.4.408) in the three dimensional model of the Stratum (see 4.2.677).

The data associated with a Design_intent_modification_in_stratum_3d_position are the following:

— feature_shape;

— stratum_shape;

— transformation.

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4.2.230.1 feature_shape

The feature_shape specifies the role of either the Design_intent_modification_3d_shape (see 5.2.4.16) or of the Design_intent_modification_non_planar_2d_shape (see 5.2.4.191) for the Design_intent_modification_in_stratum_3d_position.

4.2.230.2 stratum_shape

The stratum_shape specifies the role of the Stratum_3d_shape (see 5.2.4.410) for the Design_intent_-modification_in_stratum_3d_position.

4.2.230.3 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Design_intent_-modification_in_stratum_3d_position.

4.2.231 Design_intent_modification_in_stratum_planar_position

A Design_intent_modification_in_stratum_planar_position is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_in_stratum_planar_position is the two dimensional position and orientation of a two dimensional model of a Design_intent_modification (see 5.2.4.408) in the two dimensional model of the Stratum (see 4.2.677).

The data associated with a Design_intent_modification_in_stratum_planar_position are the following:

— feature_shape;

— stratum_shape;

— transformation.

4.2.231.1 feature_shape

The feature_shape specifies either a Design_intent_modification_planar_shape (see 5.2.4.370) or a Design_intent_modification_styled_area_representation (see 5.2.4.24) for the Design_intent_modification_-in_stratum_planar_position.

4.2.231.2 stratum_shape

The stratum_shape specifies the role of the Stratum_planar_shape (see 5.2.4.206) for the Design_intent_-modification_in_stratum_planar_position.

4.2.231.3 transformation

The transformation specifies the role of the Axis_placement_2d (see 4.2.44) for the Design_intent_-modification_in_stratum_planar_position.

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4.2.232 Design_intent_modification_non_planar_2d_shape

A Design_intent_modification_non_planar_2d_shape is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_non_planar_2d_shape is the representation of a Design_intent_modification (see 5.2.4.408) by a Open_shell_based_surface (see 5.2.4.39).

The data associated with a Design_intent_modification_non_planar_2d_shape are the following:

— represented_design_intent_modification;

— shape_representation.

4.2.232.1 represented_design_intent_modification

The represented_design_intent_modification specifies the Design_intent_modification (see 5.2.4.408) that is to be characterized by the Design_intent_modification_non_planar_2d_shape.

4.2.232.2 shape_representation

The shape_representation specifies the Open_shell_based_surface (see 5.2.4.39) for the representation of the Design_intent_modification (see 5.2.4.408).

4.2.233 Design_intent_modification_planar_shape

A Design_intent_modification_planar_shape is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_planar_shape is the representation of a Design_intent_modification (see 5.2.4.408) by a Planar_projected_shape (see 5.2.4.45).

The data associated with a Design_intent_modification_planar_shape are the following:

— represented_design_intent_modification;

— shape_representation.

4.2.233.1 represented_design_intent_modification

The represented_design_intent_modification specifies the Design_intent_modification (see 5.2.4.408) that is to be characterized by the Design_intent_modification_planar_shape.

4.2.233.2 shape_representation

The shape_surface_representation specifies the Planar_projected_shape (see 5.2.4.45) for the representation of the Design_intent_modification (see 5.2.4.408).

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4.2.234 Design_intent_modification_sequence

A Design_intent_modification_sequence is a type of Managed_design_object (see 4.2.431). A Design_-intent_modification_sequence is a link in a sequence of design modifications that results‘ in the completed design.

The data associated with a Design_intent_modification_sequence are the following:

— precedent_modification;

— subsequent_modification.

4.2.234.1 precedent_modification

The precedent_modification specifies the previous Design_intent_modification (see 5.2.4.408) for the Design_intent_modification_sequence.

4.2.234.2 subsequent_modification

The subsequent_modification specifies the subsequent Design_intent_modification (see 5.2.4.408) for the Design_intent_modification_sequence.

Constraints:

UR1: The combination of the precedent_modification and the subsequent_modification shall be unique within a population of Design_intent_modification_sequences.

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4.2.235 Design_intent_modification_styled_area_representation

A Design_intent_modification_styled_area_representation is a type of Managed_design_object (see 4.2.431). A Design_intent_modification_styled_area_representation is the representation of one or more Design_intent_modification (see 5.2.4.408) as one of a Fill_area_occurrence (see 5.2.4.69), or a Styled_curve_occurrence (see 5.2.4.81). A Design_intent_modification_styled_area_representation is parametric data provided to support an algorithm that calculates explicit geometry. Since the geometry may be discontiguous (fill may included dashed lines), more than one Design_intent_modification (see 5.2.4.408) may be referenced by Design_intent_modification_styled_area_representation as the resulting product data of the algorithm execution. The geometric data resulting from execution of the algorithm shall be included in Design_intent_modification_planar_shape (see 5.2.4.370) if it is not desired to exchange the Design_intent_modification_styled_area_representation. Exchanging or sharing both the Design_intent_modification_styled_area_representation and the Design_intent_modification_planar_shape that result from execution of the algorithm may be appropriate. Therefore an optional attribute that specifies the planar shapes that are derived from the Design_intent_modification_styled_area_representation is to be included in an exchange if both the planar shape and the styled area representation is included. The units used in the Design_intent_modification_styled_area_representation shall be those specified in the global geometric context for the Interconnect_module (see 4.2.372) design as specified by Cartesian_coordinate_system (see 4.2.66). If the geometry is contiguous, there shall be only one Design_intent_modification referenced.

The data associated with a Design_intent_modification_styled_area_representation are the following:

— derived_planar_shape;

— represented_design_intent_modification;

— shape_styled_area_representation.

4.2.235.1 derived_planar_shape

The derived_planar_shape specifies the Design_intent_modification_planar_shape for the Design_intent_modification_styled_area_representation. There may be more than one Design_intent_modification_planar_shape for the Design_intent_modification_styled_area_representation. A Design_intent_modification_planar_shape need not be provided for the Design_intent_modification_styled_area_representation.

4.2.235.2 represented_design_intent_modification

The represented_design_intent_modification specifies the Design_intent_modification that is characterized by this Design_intent_modification_styled_area_representation. There may be more than one Design_intent_modification for the Design_intent_modification_styled_area_representation.

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4.2.235.3 shape_styled_area_representation

The shape_styled_area_representation specifies one of a Fill_area_occurrence (see 5.2.4.69), or a Styled_-curve_occurrence (see 5.2.4.81) that represents the modification in the Design_intent.

4.2.236 Design_layer_stratum

A Design_layer_stratum is a type of Stratum (see 4.2.677) incorporated into an Interconnect_module (see 4.2.372) for the purpose of realizing a physical network in one material.

NOTE Design_layer_stratum are usually described as a signal layer or a power or ground plane.

The data associated with a Design_layer_stratum are the following:

— existence_dependence;

— of_technology;

— primary_design_layer_stratum.

4.2.236.1 existence_dependence

The existence_dependence is an inverse relationship that specifies that the existence of the Design_-layer_stratum is dependent on the existence of the Layer_connection_point (see 5.2.4.420) that specifies the Design_layer_stratum as its resident_design_layer_stratum. There shall be one or more Layer_-connection_point for a Design_layer_stratum.

4.2.236.2 of_technology

The of_technology specifies the role of the Design_layer_technology (see 5.2.4.87) for the Design_-layer_stratum.

4.2.236.3 primary_design_layer_stratum

The primary_design_layer_stratum specifies whether or not the Design_layer_stratum is the primary_-stratum of the product. The value of TRUE indicates that the Design_layer_stratum is the primary_-design_layer_stratum, meaning that it is the stratum occupying the side of the product that has been arbitrarily chosen to be the primary side. The value of FALSE indicates that the Design_layer_stratum is not the primary_design_layer_stratum.

NOTE Usual industry practice is to specify the primary stratum as that which has more components or more active components on it, but this part of ISO 10303 does not enforce that practice.

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Constraints:

WR1: The value of TRUE shall be specified for exactly one member of Design_layer_stratum in the design.

4.2.237 Design_layer_technology

A Design_layer_technology is a type of Stratum_technology (see 4.2.702). The Design_layer_technology is a technology specification tailored for those materials intended to be used to implement the direct connectivity as described in a design. The same Design_layer_technology may be used in multiple designs for multiple products, since there is no dependence of the Design_layer_technology on the design referencing it.

The data associated with a Design_layer_technology are the following:

— design_layer_position;

— design_layer_purpose;

— minimum_finished_feature_size;

— minimum_finished_feature_spacing.

4.2.237.1 design_layer_position

The design_layer_position specifies one of an internal, primary, or secondary position of the Design_layer_stratum (see 5.2.4.382) for the Design_layer_technology.

4.2.237.2 design_layer_purpose

The design_layer_purpose specifies one of the lands_only, other_signal, or power_or_ground purpose of the Design_layer_stratum (see 5.2.4.382) for the Design_layer_technology.

4.2.237.3 minimum_finished_feature_size

The minimum_finished_feature_size specifies the Length_data_element (see 4.2.422) of the smallest permissible extent of a feature for the Design_layer_technology.

4.2.237.4 minimum_finished_feature_spacing

The minimum_finished_feature_spacing specifies the Length_data_element (see 4.2.422) of the smallest permissible distance between features for the Design_layer_technology.

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4.2.238 Design_object_management_relationship

A Design_object_management_relationship is one of an Add_design_object_management_relationship (see 4.2.1), a Change_design_object_management_relationship (see 4.2.74), or a Delete_design_object_management_relationship (see 5.2.4.149). A Design_object_management_relationship is the association between the Ee_product_definition (see 5.2.4.143) changed from to the Ee_product_definition changed to.

The data associated with a Design_object_management_relationship are the following:

— current_design;

— previous_design.

4.2.238.1 current_design

The current_design specifies the current Ee_product_definition (see 5.2.4.143), after the change, for the Design_object_management_relationship.

4.2.238.2 previous_design

The previous_design specifies the Ee_product_definition (see 5.2.4.143), before the change, for the Design_object_management_relationship.

Constraints:

WR1: The current_design shall not be the previous_design.

WR2: The type of both Ee_product_definitions shall be the same (e.g., both assembly_module).

4.2.239 Design_requirement_occurrence

A Design_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283). A Design_requirement_occurrence may be an Interface_requirement_occurrence (see 5.2.4.176).

4.2.240 Design_specification

A Design_specification is a type of Ee_specification (see 4.2.292) that establishes the design specifications of products. A Design_specification may be an Interface_specification (see 5.2.4.179). These specifications are not determined by other design or construction features or by referenced data.

4.2.241 Device_2d_position

A Device_2d_position is a type of Managed_design_object (see 4.2.431). A Device_2d_position is the location in two dimensions of a Part_device (see 5.2.4.225) within a Packaged_part (see 4.2.481).

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The data associated with a Device_2d_position are the following:

— device_shape;

— part_shape;

— placed_device;

— transformation.

4.2.241.1 device_shape

The device_shape specifies the Physical_unit_planar_shape (see 4.2.536) of the Part_device (see 5.2.4.225) for the Device_2d_position.

4.2.241.2 part_shape

The part_shape specifies the Physical_unit_planar_shape (see 4.2.536) of the Packaged_part (see 4.2.481) for the Device_2d_position.

4.2.241.3 placed_device

The placed_device specifies the role of the Part_device (see 5.2.4.225) for the Device_2d_position.

4.2.241.4 transformation

The transformation specifies the role of the Axis_placement_2d (see 4.2.44) for the Device_2d_position.

4.2.242 Device_3d_position

A Device_3d_position is a type of Managed_design_object (see 4.2.431). A Device_3d_position is the location in three dimensions of a Part_device (see 5.2.4.225) within a Packaged_part (see 4.2.481).

The data associated with a Device_3d_position are the following:

— device_shape;

— part_shape;

— placed_device;

— transformation.

4.2.242.1 device_shape

The device_shape specifies the Physical_unit_3d_shape (see 4.2.534) of the Part_device (see 5.2.4.225) for the Device_3d_position.

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4.2.242.2 part_shape

The part_shape specifies the Physical_unit_3d_shape (see 4.2.534) of the Packaged_part (see 4.2.481) for the Device_3d_position.

4.2.242.3 placed_device

The placed_device specifies the role of the Part_device (see 5.2.4.225) for the Device_3d_position.

4.2.242.4 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Device_3d_position.

4.2.243 Device_terminal_map

A Device_terminal_map is a type of Managed_design_object (see 4.2.431). A Device_terminal_map is the association between a Part_device_terminal (see 5.2.4.259) and a Packaged_part_terminal (see 5.2.4.310). A Device_terminal_map provides the topological equivalent of a bond wire from the package terminal to the terminal of the installed Part_device (see 5.2.4.225).

The data associated with a Device_terminal_map are the following:

— mapped_device_terminal;

— target_terminal.

4.2.243.1 mapped_device_terminal

The mapped_device_terminal specifies the Part_device_terminal (see 5.2.4.259) from which the association is made to the target_terminal by the Device_terminal_map.

4.2.243.2 target_terminal

The target_terminal specifies the targeted Packaged_part_terminal (see 5.2.4.310) for the Device_terminal_map.

Constraints:

UR1: The combination of the target_terminal and mapped_device_terminal shall be unique within a population of Device_terminal_map.

WR1: The mapped_device_terminal and the target_terminal shall be in the context of the same Packaged_part.

NOTE Reference Part_device_terminal_model_port_assignment for Analytical_model_port_assignment.

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4.2.244 Device_terminal_map_relationship

A Device_terminal_map_relationship is a type of Managed_design_object (see 4.2.431). A Device_terminal_map_relationship is the association of one Device_terminal_map (see 5.2.4.241) to another.

The data associated with a Device_terminal_map_relationship are the following:

— related_device_terminal_map;

— relating_device_terminal_map.

4.2.244.1 related_device_terminal_map

The related_device_terminal_map specifies the target Device_terminal_map (see 5.2.4.241) in the Device_terminal_map_relationship.

4.2.244.2 relating_device_terminal_map

The relating_device_terminal_map specifies the source Device_terminal_map (see 5.2.4.241) in the Device_terminal_map_relationship.

4.2.245 Diametrical_boundary_size_characteristic

A Diametrical_boundary_size_characteristic is a type of Boundary_size_characteristic (see 4.2.60) that defines the diameter of a Tolerance_zone_circular_or_cylindrical_or_spherical_boundary (see 5.2.4.336).

The data associated with a Diametrical_boundary_size_characteristic are the following:

— sized_boundary.

4.2.245.1 sized_boundary

The sized_boundary specifies the Tolerance_zone_circular_or_cylindrical_or_spherical_boundary (see 5.2.4.336), the diameter of which is defined by the Diametrical_boundary_size_characteristic.

Constraints:

WR1: The Tolerance_zone_boundary specified by the sized_boundary shall be the same instance of Tolerance_zone_boundary as specified by the defined_zone_boundary of the Boundary_zone_definition_with_specified_size that is specified as the boundary_definition.

NOTE The attribute boundary_definition is declared in the Boundary_size_characteristic entity of which this entity is a subtype.

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4.2.246 Dielectric_crossover_area

A Dielectric_crossover_area is a type of Stratum_concept_relationship (see 5.2.4.359) that relates one Stratum_feature (see 4.2.683) with another that results in the creation of a dielectric crossover feature in a dielectric Stratum (see 4.2.677).

The data associated with a Dielectric_crossover_area are the following:

— related_concept;

— relating_concept;

— resulting_dielectric_crossover.

4.2.246.1 related_concept

The related_concept specifies the source Stratum_feature (see 4.2.683) for the Dielectric_crossover_area.

4.2.246.2 relating_concept

The relating_concept specifies the target Stratum_feature (see 4.2.683) for the Dielectric_crossover_area.

4.2.246.3 resulting_dielectric_crossover

The resulting_dielectric_crossover specifies the Stratum_feature (see 4.2.683) in a stratum of dielectric material for the Dielectric_crossover_area.

Constraints:

WR1: The Stratum on which the Stratum_features reside related to this Dielectric_crossover_area shall be arranged such that the resulting_dielectric_crossover is between the relating_concept and the related_concept.

NOTE There is no directionality implied by the use of "related", "relating" in the attribute names.

WR2: The relating_concept shall not be the related_concept.

4.2.247 Dielectric_material_passage

A Dielectric_material_passage is a type of Inter_stratum_feature (see 4.2.364) that contains dielectric material. The extent of the Dielectric_material_passage is between the boundary defined by the shape_definition of this Dielectric_material_passage and the shape of the Cutout that is to be filled with dielectric material during manufacture.

EXAMPLE 1 Figure 5.2.4.372 illustrates an exploded, stylized, detail of a Dielectric_material_passage as it appears in two sequential stages of the fabrication process.

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The data associated with a Dielectric_material_passage are the following:

— feature_material;

— precedent_passage.

EXAMPLE 2 A Dielectric_material_passage is used, for example, in printed circuit boards with metal core Stratum for thermal conductivity, that have oversized passages created through the metal Stratum before bonding. These oversized passages in the metal Stratum are filled with dielectric material during the bonding process for later machining to suit the eventual purpose for the passage at that location. These smaller passages are often plated for electrical continuity among Design_layer_stratums on either side of the metal core, but there must be electrical isolation between the plating in the passage and the metal thermal conductive Stratum. The dielectric fill material provides that isolation.

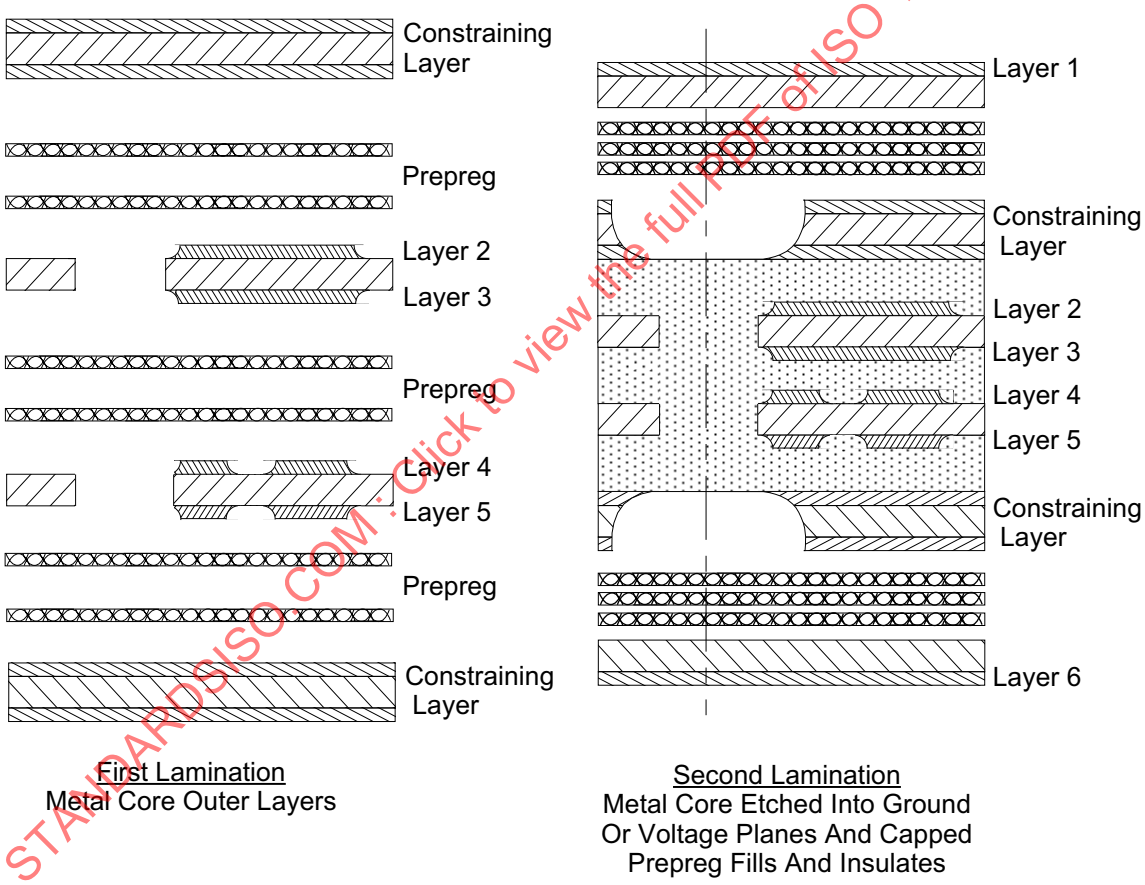

Figure 42 – Dielectric_material_passage exploded view

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4.2.247.1 feature_material

The feature_material specifies either the Ee_material (see 4.2.273) or the Ee_requirement_occurrence (see 4.2.283) that defines the dielectric material contained in the Dielectric_material_passage. The feature_material need not be specified for a particular Dielectric_material_passage.

4.2.247.2 precedent_passage

The precedent_passage specifies the Cutout (see 5.2.4.31) that defines the outer boundary of the Dielectric_material_passage before it is filled with the specified non-conductive Ee_material (see 4.2.273).

Constraints:

WR1: The same material shall exist throughout the extent of the passage.

4.2.248 Digital_analytical_model_port

A Digital_analytical_model_port is a type of Analytical_model_port (see 4.2.11) that defines a digital context.

The data associated with a Digital_analytical_model_port are the following:

— nominal_signal_flow_direction.

4.2.248.1 nominal_signal_flow_direction

The nominal_signal_flow_direction specifies either BIDIRECTIONAL, INPUT_DIRECTION, NOT_APPLICABLE, OUTPUT_DIRECTION, or UNKNOWN_DIRECTION for the Digital_analytical_model_port.

Constraints:

WR1: "NOT_APPLICABLE" is not an allowed value.

4.2.249 Dimension_along_curve

A Dimension_along_curve is a type of Dimensional_location (see 4.2.258) that defines the location of a Shape_element (see 4.2.645) in relationship to another Shape_element and in which a Shape_element is specified as the path along which the Dimension_along_curve characterizes this relationship.

The data associated with a Dimension_along_curve are the following:

— path.

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4.2.249.1 path

The path specifies the Shape_element (see 4.2.645) along which the relationship between the two Shape_-elements is characterized by the Dimension_along_curve.

Constraints:

UR1: The combination of located_elements inherited from Dimensional_location and path shall be unique within a population of Dimension_along_curve.

WR1: The dimension_type of the Dimension_location_with_direction_vector shall be either "arc_length", or "linear".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

4.2.250 Dimension_location_with_direction_vector

A Dimension_location_with_direction_vector is a type of Dimensional_location (see 4.2.258) in which the characterization of the relationship between the two Shape_element (see 4.2.645) is dependent on a vector that establishes a measurement direction.

The data associated with a Dimension_location_with_direction_vector are the following:

— measurement_direction.

4.2.250.1 measurement_direction

The measurement_direction either specifies the Datum_based_vector_orientation (see 4.2.182) or the Axis_placement (see 4.2.43) that establishes the measurement direction. If the measurement_direction specifies a Datum_based_vector_orientation, the measurement direction is established from Datum (see 4.2.176). If the measurement_direction specifies an Axis_placement, the measurement direction is based on the Axis_placement and the representation of the Shape_elements whose relationship is characterized by the Dimension_location_with_direction_vector.

Constraints:

UR1: The combination of located_elements inherited from Dimensional_location and measurement_-direction shall be unique within a population of Dimension_location_with_direction_vector.

NOTE The attribute located_elements is declared in the Dimensional_location entity of which this entity is a subtype.

WR1: The dimension_type of the Dimension_location_with_direction_vector shall be "linear".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

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IP1: If the measurement_direction specifies an Axis_placement, the Axis_placement shall be in the same context as the representation of the two Shape_elements that are located relative to each other by the Dimension_location_with_direction_vector.

4.2.251 Dimension_location_with_specified_datum_system

A Dimension_location_with_specified_datum_system is a type of Dimensional_location (see 4.2.258) that is related to a Datum_reference_frame (see 5.2.4.302).

The data associated with a Dimension_location_with_specified_datum_system are the following:

— referenced_datum_system_defining_conditions.

4.2.251.1 referenced_datum_system_defining_conditions

The referenced_datum_system_defining_conditions specifies the Datum_system_defining_conditions_-without_material_conditions (see 5.2.4.25) that defines the order of precedence for the datums of a Datum_system (see 5.2.4.316) which in turn establishes the Datum_reference_frame (see 5.2.4.302) to which the Dimension_location_with_specified_datum_system is related.

NOTE The specification of the relationship between linear and angular dimensions to a datum reference frame is discussed in 4.4 of ASME Y14.5M.

4.2.252 Dimension_qualifier

A Dimension_qualifier is a type of Managed_design_object (see 4.2.431). A Dimension_qualifier is either a Pre_defined_dimension_qualifier (see 5.2.4.349) or a User_defined_dimension_qualifier (see 5.2.4.350). A Dimension_qualifier is a description that qualifies one or more Dimensional_characteristic (see 4.2.256).

NOTE Qualifying notes are described in 5.3 of ISO/DIS 1101.

The data associated with a Dimension_qualifier are the following:

— qualified_dimensions.

4.2.252.1 qualified_dimensions

The qualified_dimensions specifies the Dimensional_characteristic (see 4.2.256) to which the Dimension_qualifier applies. There shall be one or more Dimensional_characteristic specified as the qualified_dimensions for a Dimension_qualifier.

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4.2.253 Dimension_related_positional_boundary

A Dimension_related_positional_boundary is a type of Positional_boundary (see 4.2.561) that is a theoretical boundary that is composed of a set of one or more Positional_boundary_member (see 5.2.4.321). Each Positional_boundary_member is defined by a separate Boundary_based_position_tolerance (see 4.2.59) in conjunction with a Dimensional_size (see 4.2.259).

The data associated with a Dimension_related_positional_boundary are the following:

— boundary_members;

— constrained_physical_feature.

4.2.253.1 boundary_members

The boundary_members specifies the Positional_boundary_member (see 5.2.4.321) that comprise the Dimension_related_positional_boundary. There shall be one or more Positional_boundary_member specified as the boundary_members for the Dimension_related_positional_boundary.

4.2.253.2 constrained_physical_feature

The constrained_physical_feature specifies the Physical_feature_or_part_template (see 4.2.527) that is to be constrained by the Dimension_related_positional_boundary.

Constraints:

WR1: The Positional_boundary_definition specified as the boundary_definition shall be a Dimension_related_positional_boundary_definition.

NOTE The attribute boundary_definition is declared in the Positional_boundary entity of which this entity is a subtype.

4.2.254 Dimension_related_positional_boundary_definition

A Dimension_related_positional_boundary_definition is a type of Positional_boundary_definition (see 5.2.4.323) that characterizes a Dimension_related_positional_boundary (see 5.2.4.390).

The data associated with a Dimension_related_positional_boundary_definition are the following:

— characterized_boundary_member_definitions;

— defined_positional_boundary.

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4.2.254.1 characterized_boundary_member_definitions

The characterized_boundary_member_definitions specifies the Positional_boundary_member_definition (see 5.2.4.324) that characterize each Positional_boundary_member (see 5.2.4.321) that comprise the Dimension_related_positional_boundary (see 5.2.4.390). There shall be one or more Positional_boundary_member_definition specified as the characterized_boundary_member_definitions for the Dimension_related_positional_boundary_definition.

4.2.254.2 defined_positional_boundary

The defined_positional_boundary specifies the Dimension_related_positional_boundary (see 5.2.4.390) that is characterized by the Dimension_related_positional_boundary_definition.

Constraints:

WR1: Each Boundary_based_position_tolerance that defines a Positional_boundary_member_definition of the Positional_boundary_definition shall reference the same instance of Datum_system_defining_conditions.

WR2: Each Boundary_based_position_tolerance that defines a Positional_boundary_member_definition of the Positional_boundary_definition shall have the same value for the applied_material_condition_property_name.

4.2.255 Dimension_set

A Dimension_set is a type of Managed_design_object (see 4.2.431). A Dimension_set is a set of Dimensional_characteristic (see 4.2.256) that specify the theoretically exact shape of a Physical_feature_or_part_template (see 4.2.527).

The data associated with a Dimension_set are the following:

— associated_dimensions.

4.2.255.1 associated_dimensions

The associated_dimensions specifies the Dimensional_characteristic (see 4.2.256) that are associated with the Dimension_set. There shall be one or more Dimensional_characteristic specified as the associated_dimensions for the Dimension_set.

Constraints:

WR1: The Dimension_set shall be specified as the profile_representation by at least one True_profile.

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4.2.256 Dimensional_characteristic

A Dimensional_characteristic is a type of Managed_design_object (see 4.2.431). A Dimensional_characteristic is either a Dimensional_location (see 4.2.258) or a Dimensional_size (see 4.2.259) that characterizes either the spatial constraints between two Shape_element (see 4.2.645) or the size of a Shape_element. Additionally, a Dimensional_characteristic may be a Statistical_dimensional_tolerance (see 5.2.4.55).

The data associated with a Dimensional_characteristic are the following:

— dimension_type.

4.2.256.1 dimension_type

The dimension_type specifies the label by which the Dimensional_characteristic is known. The dimension_type shall be one of "angular", "arc_length", "controlled_radius", "diameter", "linear", or "radius".

NOTE A description of controlled radius is given in 2.15.2 of ASME Y14.5M.

Constraints:

WR1: The Dimensional_characteristic shall be specified as the dimension by at most one Dimensional_characteristic_representation that specifies a value of FALSE for the auxiliary_dimension_representation.

WR2: If the dimension_type is "angular" and the Dimensional_characteristic is represented by a Shape_dimension_representation that specifies one or more Data_element, each Data_element shall be an Angle_data_element.

WR3: The Dimensional_characteristic shall either be a Dimensional_size or a Dimensional_location.

WR4: If the dimension_type is other than "angular" and the Dimensional_characteristic is represented by a Shape_dimension_representation that specifies one or more Data_element, each Data_element shall be a Length_data_element.

WR5: There shall be exactly one Ee_requirement_occurrence with the description of "Geometric Dimensioning and Tolerancing Reference" that specifies at least one Ee_specification as the requirement_specification.

IP1: There shall be exactly one Ee_requirement_occurrence with the description of "Geometric Dimensioning and Tolerancing Reference" that specifies at least one Ee_specification as the requirement_specification. The Ee_specification shall reference those standards by which the geometric dimensioning and tolerancing data is to be interpreted.

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4.2.257 Dimensional_characteristic_representation

A Dimensional_characteristic_representation is a type of Managed_design_object (see 4.2.431). A Dimensional_characteristic_representation is an association between a Dimensional_characteristic (see 4.2.256) and the Shape_dimension_representation (see 4.2.644) that represents the Dimensional_characteristic.

The data associated with a Dimensional_characteristic_representation are the following:

— auxiliary_dimension_representation;

— dimension;

— representation.

4.2.257.1 auxiliary_dimension_representation

The auxiliary_dimension_representation specifies the boolean value that indicates whether the associated Shape_dimension_representation (see 4.2.644) is to be considered a requirement for the associated Dimensional_characteristic (see 4.2.256) or is specified for informational purposes only. A value of TRUE indicates that the associated Shape_dimension_representation is for informational purposes only. A value of FALSE indicates that the associated Shape_dimension_representation is to be considered a requirement.

NOTE Auxiliary dimension is defined in 3.1.1.3 of ISO 129.

4.2.257.2 dimension

The dimension specifies either a Dimensional_location (see 4.2.258) or a Dimensional_size (see 4.2.259) that is represented by the specified Shape_dimension_representation (see 4.2.644) for the Dimensional_characteristic_representation.

4.2.257.3 representation

The representation specifies the Shape_dimension_representation (see 4.2.644) that represents the specified Dimensional_characteristic (see 4.2.256) for the Dimensional_characteristic_representation.

4.2.258 Dimensional_location

A Dimensional_location is a type of Dimensional_characteristic (see 4.2.256) that defines the location of a Shape_element (see 4.2.645) relative to another Shape_element. A Dimensional_location may be one of an Angular_dimension_with_direction_vector (see 4.2.18), a Dimension_along_curve (see 5.2.4.36), or a Dimension_location_with_direction_vector (see 5.2.4.37). Additionally, the Dimensional_location may be a Dimension_location_with_specified_datum_system (see 5.2.4.120).

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The data associated with a Dimensional_location are the following:

— directed;

— located_elements.

4.2.258.1 directed

The directed specifies the boolean value that indicates whether there is significance to the direction of measure of the Dimensional_location. A value of TRUE indicates that the measurement direction shall be from the Shape_element (see 4.2.645) specified as the locating_shape_element to the Shape_element specified as the located_shape_element by the Shape_element_locating_relationship (see 4.2.650) that is characterized by the Dimensional_location. A value of FALSE indicates that there is no significance placed on the direction of measure.

4.2.258.2 located_elements

The located_elements specifies the Shape_element_locating_relationship (see 4.2.650) that specifies the two Shape_elements for which the relationship is characterized by the Dimensional_location.

Constraints:

WR1: The dimension_type of the Dimensional_location shall not be "diameter".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

4.2.259 Dimensional_size

A Dimensional_size is a type of Dimensional_characteristic (see 4.2.256) that defines the size of a Shape_element (see 4.2.645). A Dimensional_size is either a Dimensional_size_based_on_opposing_-boundaries (see 4.2.260), or a Single_boundary_dimension (see 4.2.661). Additionally, a Dimensional_-size may be an Angular_size_dimension (see 4.2.19).

The data associated with a Dimensional_size are the following:

— envelope;

— size_of.

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4.2.259.1 envelope

The envelope specifies the boolean value that indicates whether or not the Shape_element (see 4.2.645) for which the size is characterized by the Dimensional_size has the additional requirement that it shall not violate the envelope of perfect form at the maximum material size of the Shape_element. A value of TRUE indicates that the requirement is in effect. A value of FALSE indicates that the requirement is not in effect.

NOTE The envelope requirement is described in 6.1 of ISO 8015.

4.2.259.2 size_of

The size_of specifies the Shape_element (see 4.2.645) for which the size is characterized by the Dimensional_size.

4.2.260 Dimensional_size_based_on_opposing_boundaries

A Dimensional_size_based_on_opposing_boundaries is a type of Dimensional_size (see 4.2.259) that characterizes the size of a Composite_unit_shape_element (see 5.2.4.63) as well as characterizing the relationship between two opposing Shape_element (see 4.2.645) from which the Composite_shape_element (see 5.2.4.125) is composed.

The data associated with a Dimensional_size_based_on_opposing_boundaries are the following:

— boundary_separation;

— size_of.

4.2.260.1 boundary_separation

The boundary_separation specifies the Shape_element_locating_relationship (see 4.2.650) that specifies the two Shape_elements that are on the boundary of the Composite_unit_shape_element (see 5.2.4.63) for which the separation is characterized by the Dimensional_size_based_on_opposing_boundaries and is the basis for the size of the Composite_unit_shape_element.

4.2.260.2 size_of

The size_of specifies the Composite_unit_shape_element (see 5.2.4.63) for which the size is characterized by the Dimensional_size_based_on_opposing_boundaries.

NOTE The attribute size_of is declared in the Dimensional_size (see 4.2.259) entity of which this entity is a subtype.

EXAMPLE 1 The size of a Shape_element (see 4.2.645) that consists of two opposing surfaces of a notch would be characterized by a Dimensional_size_based_on_opposing_boundaries.

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Constraints:

WR1: The Shape_element that is specified as the located_shape_element by the Shape_element_locating_relationship specified as the boundary_separation shall be specified as the related_shape_element by a Shape_element_composing_relationship that specifies the Composite_unit_shape_element that is specified as the size_of as the relating_shape_element.

WR2: The Shape_element that is specified as the locating_shape_element by the Shape_element_locating_relationship specified as the boundary_separation shall be specified as the related_shape_element by a Shape_element_composing_relationship that specifies the Composite_unit_shape_element that is specified as the size_of as the relating_shape_element.

WR3: The dimension_type shall be either "angular" or "linear".

NOTE The attribute dimension_type is declared in the Dimensional_characteristic entity of which this entity is a subtype.

IP1: The two shape elements that correspond to the Shape_elements that compose the Composite_unit_shape_element to which the Dimensional_size_based_on_opposing_boundaries is applied shall be opposite each other.

4.2.261 Directed_axis

A Directed_axis is a type of Non_feature_shape_element (see 5.2.4.127) that is an axis in which a direction is defined. A Directed_axis is defined by a base Centre_axis (see 4.2.69), with which the Directed_axis is congruent, and two Shape_element (see 4.2.645) through which the base Centre_axis passes or would pass if the Shape_elements were extended. One of the two Shape_elements is specified as the start_shape_element and the other one specified as the end_shape_element.

The data associated with a Directed_axis are the following:

— axis_to_be_oriented;

— end_shape_element;

— start_shape_element.

4.2.261.1 axis_to_be_oriented

The axis_to_be_oriented specifies the Centre_axis (see 4.2.69) that serves as a base axis by which the Directed_axis is defined.

4.2.261.2 end_shape_element

The end_shape_element specifies the Shape_element (see 4.2.645) through which the Directed_axis passes or would pass if the Shape_element were extended. The Shape_element specified by the end_shape_element is in the positive direction from the Shape_element specified by the start_shape_element.

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4.2.261.3 start_shape_element

The start_shape_element specifies the Shape_element (see 4.2.645) through which the Directed_axis passes or would pass if the Shape_element were extended. The Shape_element specified by the start_shape_element is in the negative direction from the Shape_element specified by the end_shape_element.

Constraints:

UR1: The combination of axis_to_be_oriented and start_shape_element shall be unique within a population of Directed_axis.

WR1: The Shape_element specified by the start_shape_element shall not be the same Shape_element as specified by the end_shape_element.

IP1: The base Centre_axis shall pass through or would pass through the Shape_elements specified by the start_shape_element and end_shape_element if the Shape_elements were extended.

4.2.262 Direction_element

A Direction_element is a type of Managed_design_object (see 4.2.431). A Direction_element is a definition of a shape element that has the form of a half-plane and is used in conjunction with the definition of another half-plane shape element to define a Datum_based_vector_orientation (see 4.2.182). In this instance a half-plane has the form of a plane except it is bounded on one side by a straight line. The half-plane shape element that the Direction_element defines is oriented with respect to three Datum_plane (see 5.2.4.129).

The data associated with a Direction_element are the following:

— angle_value;

— base_datum_plane;

— direction;

— direction_of_half_datum_plane;

— elements_of.

4.2.262.1 angle_value

The angle_value specifies the Angle_data_element (see 4.2.17) that represents the magnitude of the angle between the half-plane shape element defined by the Direction_element and half of the Datum_plane (see 5.2.4.129) specified as the base_datum_plane.

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4.2.262.2 base_datum_plane

The base_datum_plane specifies the Datum_plane (see 5.2.4.129) from which the half-plane shape element defined by the Direction_element is oriented.

4.2.262.3 direction

The direction specifies the Datum_based_direction_vector (see 5.2.4.182) that defines the orientation of the angle between the half-plane shape element defined by the Direction_element and half of the Datum_plane (see 5.2.4.129) specified by the base_datum_plane. The angle is measured from half of the base Datum_plane to the defined half-plane shape element in a clockwise direction when viewed in the direction of the Datum_based_direction_vector.

4.2.262.4 direction_of_half_datum_plane

The direction_of_half_datum_plane specifies the Datum_based_direction_vector (see 5.2.4.182) of a Datum_plane (see 5.2.4.129) that intersects the base Datum_plane and indicates the half of the base Datum_plane from which the half-plane shape element defined by the Direction_element is oriented.

4.2.262.5 elements_of

The elements_of is an inverse relationship that specifies that the existence of the Direction_element is dependent on the existence of one or more Datum_based_vector_orientation (see 4.2.182) that specifies the Direction_element as one of their direction_components.

Constraints:

WR1: The Datum_plane specified as the base_datum_plane, the Datum_plane specified as the vector_of by the Datum_based_direction_vector that is specified as the direction, the Datum_plane specified as the vector_of by the Datum_based_direction_vector that is specified as the direction_of_half_datum_plane shall be different.

WR2: The Datum_plane specified as the base_datum_plane, and the Datum_plane specified as the vector_of by the Datum_based_direction_vector that is specified as the direction, and the Datum_plane specified as the vector_of by the Datum_based_direction_vector that is specified as the direction_of_half_datum_plane shall be Datum_planes of the same Datum_reference_frame.

4.2.263 Documentation_layer_stratum

A Documentation_layer_stratum is a type of Stratum (see 4.2.677) used to describe patterns and other artwork information needed to manufacture a Stratum from materials which are not independently implementing a Physical_network (see 5.2.4.17) in the printed circuit board.

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EXAMPLE 1 A Documentation_layer_stratum generally refers to those layers in domain terms for which there is a specifically designed shape other than, or in addition to, that of the printed circuit board edge, and for which the CAD systems traditionally output a separate master artwork pattern or file, but for which the resulting pattern is not for an independent conductive layer. For a "six layer pcb", in domain terms, there are six independently conductive design layers. This part of ISO 10303 allows the "outer layers" to be described by several Stratum to accommodate the different metallurgies that are found on electroless copper plated, electrolytic copper plated, and solder plated or solder coated Stratum on the primary and secondary sides of the Interconnect_module (see 4.2.372). The usual design view of the shape of these "outer layers" is that the shapes are identical for all practical purposes and the required shape is the cumulative shape that will appear after all the manufacturing processes are completed. A Stratum of conductive material, such as solder paste, is not an independently conductive layer in this context, since its shape is usually dependent upon the independently conductive layer over which it is applied through openings in solder mask or another Documentation_layer_stratum.

NOTE The general case of dielectric layers such as the adhesive Stratum, or the Stratum consisting of the dielectric substrate between two copper foil Stratum in a printed circuit board, is that they are neither a Documentation_layer_stratum nor a Design_layer_stratum. Their shapes are totally dependent upon the overall shape of the printed circuit board and its various passages.

EXAMPLE 2 If the stratum purpose is that of a coverlay, the insulating sheet on the outer surface of a flexible printed harness and the die-cut passages in the dielectric material of the coverlay are defined as Inter_stratum_-features. A Stratum is used to describe the presence of the material. This Stratum in this context is neither a Design_layer_stratum (see 5.2.4.382) nor a Documentation_layer_stratum.

EXAMPLE 3 A Documentation_layer_stratum differs from a Design_layer_stratum in that its Ee_materials include such materials as solder maskant, epoxy ink, or dielectric materials; or materials such as solder paste that are described as conductive by the Ee_material (see 4.2.273) of the Stratum but whose shape is dependent upon that of an independently described Stratum.

EXAMPLE 4 An example of the shape of an independently described Stratum of conductive materials is that of the copper to be found in the traces and lands on the printed circuit board. The shape of a Stratum of solder paste is often dependent upon the shape of the Stratum of solder mask that in turn is dependent upon the shape of the circuitry on the primary and secondary sides of the Interconnect_module over which the solder mask and solder paste are applied.

The data associated with a Documentation_layer_stratum are the following:

— of_technology

4.2.263.1 of_technology

The of_technology specifies the role of the Documentation_layer_technology (see 5.2.4.212) for the Documentation_layer_stratum.

4.2.264 Documentation_layer_technology

A Documentation_layer_technology is a type of Stratum_technology (see 4.2.702) that defines the purpose for the Documentation_layer_stratum (see 5.2.4.62).

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The data associated with a Documentation_layer_technology are the following:

— documentation_layer_purpose.

4.2.264.1 documentation_layer_purpose

The documentation_layer_purpose specifies the string that describes the purpose for the Documentation_layer_technology.

EXAMPLE 1 Examples of these purposes are "Silkscreen", "Solder Mask", and "Solder Paste".

4.2.265 Edge_based_2d_wireframe

An Edge_based_2d_wireframe is a type of Feature_shape_definition (see 4.2.315). An Edge_based_2d_wireframe is described by a two-dimensional graph of edges and vertices. The graph may be disconnected. Within the graph the edges do not intersect except at their boundaries, otherwise known as vertices. The geometry associated with a vertex shall be consistent with the geometry associated with any of the edges of which the vertex forms a boundary.

4.2.266 Edge_based_wireframe

An Edge_based_wireframe is a type of Bound_volume_shape (see 4.2.58). An Edge_based_wireframe is described by a three-dimensional graph of edges and vertices. The graph may be disconnected. Within the graph the edges do not intersect except at their boundaries, otherwise known as vertices. The geometry associated with a vertex shall be consistent with the geometry associated with any of the edges of which the vertex forms a boundary.

4.2.267 Edge_segment_vertex

An Edge_segment_vertex is a type of Managed_design_object (see 4.2.431). An Edge_segment_vertex supports explicit assignment of the order and connection of edge start and end points but without needing to use an explicit geometric or topological context.

The data associated with an Edge_segment_vertex are the following:

— name.

4.2.267.1 name

The name specifies the identifier for the Edge_segment_vertex. The name shall be unique within a population of Edge_segment_vertex.

Constraints:

UR1: The name shall be unique within a population of Edge_segment_vertex.

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4.2.268 Edge_shape

An Edge_shape is a type of Planar_shape (see 5.2.4.231). An Edge_shape may be one or more of a Bevel_edge_feature_shape (see 4.2.51), a Radius_edge_feature_shape (see 5.2.4.237), or a Step_edge_-feature_shape (see 5.2.4.249). Edge_shape is provied to describe parametric data necessary to fabricate commonly used shapes on segments of interconnect substrates. Edge_shape applies to the entire arc length of the feature that is referencing it.

4.2.269 Ee_approval

An Ee_approval is a type of Managed_design_object (see 4.2.431). An Ee_approval is the dated indication that an Organization (see 5.2.4.135) or a Person_and_organization (see 5.2.4.275) has reviewed and approved an occurrence of something.

The data associated with an Ee_approval are the following:

— approval_status;

— authorizer;

— purpose;

— signoff_date.

4.2.269.1 approval_status

The approval_status specifies either approved, disapproved, not_yet_approved, or withdrawn as the state of consent applied to an aspect of product data as indicated by the Ee_approval.

4.2.269.2 authorizer

The authorizer specifies either a Person_and_organization (see 5.2.4.275) or an Organization (see 5.2.4.135) that authorizes the Ee_approval. There shall be one or more Person_and_organization or Organization for an Ee_approval.

4.2.269.3 purpose

The purpose specifies the Ee_text (see 4.2.293) that provides the reason for the Ee_approval.

EXAMPLE 1 Typical values include "preliminary", "detailed", or"final".

4.2.269.4 signoff_date

The signoff_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) of the Ee_-approval.

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Constraints:

WR1: There shall be something to approve for approval to exist.

4.2.270 Ee_colour

An Ee_colour is a type of Managed_design_object (see 4.2.431). An Ee_colour is the colour characterized by normalized quantities of the colours red, green, and blue in accordance with ISO/IEC 9592-1.

The data associated with an Ee_colour are the following:

— name.

4.2.270.1 name

The name specifies the string identifying the Ee_colour.

Constraints:

UR1: The name shall be unique within a population of Ee_colour.

4.2.271 Ee_document

An Ee_document is a type of Managed_design_object (see 4.2.431). An Ee_document may be an Ee_-specification (see 4.2.292). An Ee_document is a set of detailed information that describes a product or aspect of a product in detail. The information is in the form of text, tables, and graphics in a human readable language, although the hard copy may be a report from computer interpretable files.

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The data associated with an Ee_document are the following:

— author;

— base_identifier;

— change_date;

— creation_date;

— document_approval;

— document_name;

— key_phrase;

— publisher;

— revision;

— security_code;

— text_usage.

4.2.271.1 author

The author specifies the Person (see 5.2.4.251) who creates an Ee_document. The author need not be specified for a particular Ee_document. There may be more than one Person for an Ee_document.

4.2.271.2 base_identifier

The base_identifier specifies the role of the Ee_document_identifier (see 5.2.4.276) for the Ee_document.

4.2.271.3 change_date

The change_date specifies the unique Date_and_time (see 4.2.175) when updates are made to an Ee_-document. The change_date need not be specified for a particular Ee_document. There may be more than one Date_and_time for an Ee_document.

4.2.271.4 creation_date

The creation_date specifies the Date_and_time (see 4.2.175) when an Ee_document was created.

4.2.271.5 document_approval

The document_approval specifies the Ee_approval (see 4.2.269) of the Ee_document. The document_-approval need not be specified for a particular Ee_document.

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4.2.271.6 document_name

The document_name specifies the string identifying the Ee_document.

4.2.271.7 key_phrase

The key_phrase specifies the Structured_text (see 5.2.4.330) that details specific aspects within the text. The key_phrase need not be specified for a particular Ee_document. There may be more than one Structured_text for an Ee_document.

4.2.271.8 publisher

The publisher specifies the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) responsible for the Ee_document.

4.2.271.9 revision

The revision specifies the string identifying the configuration controlled version of the Ee_document. The revision need not be specified for a particular Ee_document.

4.2.271.10 security_code

The security_code specifies the Security_classification (see 4.2.642) of a particular Ee_document. The security_code need not be specified for a particular Ee_document.

4.2.271.11 text_usage

The text_usage specifies either the Ee_text (see 4.2.293) or the Structured_text (see 5.2.4.330) for an Ee_document. The text_usage need not be specified for a particular Ee_document. There may be more than one Ee_text or Structured_text for an Ee_document.

Constraints:

UR1: The base_identifier shall be unique within a population of Ee_document.

4.2.272 Ee_document_identifier

An Ee_document_identifier is a type of Managed_design_object (see 4.2.431). An Ee_document_identifier is the combination of an identifier name and an assigned value.

EXAMPLE 1 An example of an Ee_document_identifier is an International Serial Book Number, ISBN, as the identifier_name, and the number associated with a specific publication as the assigned_value. Other examples may be found in the Library of Congress system and the Dewey Decimal System.

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The data associated with an Ee_document_identifier are the following:

— assigned_value;

— identifier_name.

4.2.272.1 assigned_value

The assigned_value specifies a string identifying the content of the Ee_document_identifier.

4.2.272.2 identifier_name

The identifier_name specifies the string that establishes the context or type for the Ee_document_identifier.

Constraints:

UR1: The combination of the identifier_name and assigned_value shall be unique within a population of Ee_document_identifiers.

4.2.273 Ee_material

An Ee_material is a type of Managed_design_object (see 4.2.431). An Ee_material is the tangible nature of a manufactured or natural product.

The data associated with an Ee_material are the following:

— coordinated_material_property;

— material_description;

— material_name;

— registration_document;

— electrical_conductivity_classification;

— optical_conductivity_classification;

— thermal_conductivity_classification.

4.2.273.1 coordinated_material_property

The coordinated_material_property specifies the role of the Coordinated_characteristic (see 5.2.4.383) for the Ee_material. The coordinated_material_property need not be specified for a particular Ee_material. There may be more than one Coordinated_characteristic for the Ee_material.

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4.2.273.2 material_description

The material_description specifies the nomenclature that is a string that represents a human-interpretable means for classifying the Ee_material for the purpose of identification. The material_description need not be specified for a particular Ee_material.

4.2.273.3 material_name

The material_name specifies the descriptive label that is registered for the Ee_material in the registration_document, and that represents the name of the Ee_material.

4.2.273.4 registration_document

The registration_document specifies a dictionary of registered materials in which the material_name is found.

4.2.273.5 electrical_conductivity_classification

The electrical_conductivity_classification specifies either conductive, non_conductive, resistive, semi_-conductive. The electrical_conductivity_classification need not be specified for a particular Ee_material.

4.2.273.6 optical_conductivity_classification

The optical_conductivity_classification specifies either conductive, non_conductive, resistive, or semi_-conductive. The optical_conductivity_classification need not be specified for a particular Ee_material.

4.2.273.7 thermal_conductivity_classification

The thermal_conductivity_classification specifies either conductive, non_conductive, resistive, or semi_-conductive. The thermal_conductivity_classification need not be specified for a particular Ee_material.

Constraints:

UR1: The combination of material_name and registration_document shall be unique within a population of Ee_materials.

WR1: At least one of the following shall be provided: electrical_conductivity_classification, optical_-conductivity_classification, thermal_conductivity_classification.

4.2.274 Ee_product

An Ee_product is a type of Managed_design_object (see 4.2.431). An Ee_product is an item that is intended to be produced by or employed in a process. For the purposes of this part of ISO 10303, an Ee_product may be the result of a human endeavour that is not necessarily a manufacturing process.

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The data associated with an Ee_product are the following:

— design_owner;

— product_classification;

— product_nomenclature;

— part_number;

— product_version;

— standard_product_indicator.

4.2.274.1 design_owner

The design_owner specifies either the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) that is responsible for an Ee_product and who receives the benefits from designing and manufacturing an Ee_product.

4.2.274.2 product_classification

The product_classification is an inverse relationship that specifies that the existence of the Ee_product is dependent on the existence of the Ee_product_related_product_category (see 4.2.280) that specifies the Ee_product as its of_product.

4.2.274.3 product_nomenclature

The product_nomenclature specifies the name by which the Ee_product is commonly known within an organization.

4.2.274.4 part_number

The part_number specifies the name used as the specific identification of an Ee_product for a particular organization.

4.2.274.5 product_version

The product_version is an inverse relationship that specifies that the existence of the Ee_product is dependent on the existence of the Ee_product_version (see 4.2.282) that specifies the Ee_product as its versioned_item. There shall be one or more Ee_product_version for an Ee_product.

4.2.274.6 standard_product_indicator

The standard_product_indicator specifies whether or not an Ee_product is considered to be a standard Product for a company, industry or other organization.

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Constraints:

UR1: The combination of design_owner and part_number shall be unique within a population of Ee_-products.

4.2.275 Ee_product_category

An Ee_product_category is a type of Managed_design_object (see 4.2.431). An Ee_product_category is a class in a class hierarchy for the purpose of categorizing products according to their characteristics. An Ee_product_category may be an Ee_product_related_product_category (see 4.2.280).

The data associated with an Ee_product_category are the following:

— category_parameter;

— category_specific_values;

— name;

— reference_document.

4.2.275.1 category_parameter

The category_parameter specifies the Model_parameter (see 4.2.451) assigned to this Ee_product_category for categorization purposes. All sub-categories of this Ee_product_category shall inherit the category_parameter. There shall be one or more Model_parameter for an Ee_product_category.

4.2.275.2 category_specific_values

The category_specific_values specifies the Parameter_assignment (see 4.2.487) that assigns a specific value to a specific Model_parameter (see 4.2.451) for this Ee_product_category. All sub-categories of this Ee_product_category shall inherit the category_specific_values. There shall be one or more Parameter_assignment for an Ee_product_category.

4.2.275.3 name

The name specifies the string for the identifier for the Ee_product_category.

4.2.275.4 reference_document

The reference_document specifies the Ee_document (see 4.2.271) that is the reference for the Ee_product_category.

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Constraints:

UR1: The name shall be unique within a population of Ee_product_categories within an enterprise.

WR1: Each category_specific_value shall be assigned to one member of Model_parameter that is in the role of category_parameter in a higher level category of this Ee_product_category.

4.2.276 Ee_product_category_relationship

An Ee_product_category_relationship is a type of Managed_design_object (see 4.2.431). An Ee_product_category_relationship establishes an inheritance relationship that is a parent-child relationship between two classes in a class hierarchy of Ee_product_category (see 4.2.275).

The data associated with an Ee_product_category_relationship are the following:

— category;

— sub_category.

4.2.276.1 category

The category specifies the Ee_product_category (see 4.2.275) that is in the role of higher level category in the classification structure.

4.2.276.2 sub_category

The sub_category specifies the Ee_product_category (see 4.2.275) that inherits properties from the higher level category in the classification structure.

Constraints:

WR1: The Ee_product_category_relationship shall not establish a cyclic path in the classification structure it is a member of.

4.2.277 Ee_product_configuration

An Ee_product_configuration is a type of Managed_design_object (see 4.2.431). An Ee_product_configuration is the association of a product version with a model name that enterprise marketing provides to a customer.

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The data associated with an Ee_product_configuration are the following:

— configuration_manager;

— item_id;

— model_of_product;

— phase_of_product;

— product_configuration_approval;

— satisfying_product.

4.2.277.1 configuration_manager

The configuration_manager specifies either the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) that manages the Ee_product_configuration.

4.2.277.2 item_id

The item_id specifies the identification of an Ee_product_configuration.

4.2.277.3 model_of_product

The model_of_product specifies the role of the Ee_product_model (see 5.2.4.403) for the Ee_product_configuration.

4.2.277.4 phase_of_product

The phase_of_product specifies the string that defines the life cycle phase of the Ee_product_configuration.

EXAMPLE 1 Examples of phase_of_product include "Preliminary design", "Prototype", "Released for Production", "Obsolete for New Manufacture", and"Retired".

4.2.277.5 product_configuration_approval

The product_configuration_approval specifies the Ee_approval (see 4.2.269) that is associated with the Ee_product_configuration.

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4.2.277.6 satisfying_product

The satisfying_product specifies the Ee_product_version (see 4.2.282) that has been selected to satisfy a real or perceived customer need for the Ee_product_configuration. The satisfying_product need not be specified for a particular Ee_product_configuration. There may be more than one Ee_product_version for an Ee_product_configuration.

NOTE In some enterprises the marketing department selects product model nomenclature independent of the existence of actual product versions to satisfy the marketing requirements. This object permits the enterprise to explicitly manage the relationship between model nomenclature and the product version.

Constraints:

UR1: The combination of item_id and satisfying_product shall be unique within a population of Ee_product_configurations.

4.2.278 Ee_product_definition

An Ee_product_definition is a type of Managed_design_object (see 4.2.431). An Ee_product_definition is either a Functional_unit_definition (see 5.2.4.305) or a Physical_unit (see 4.2.533) or additionally may be an Externally_defined_ee_product_definition (see 5.2.4.404) or additionally may be a Library_ee_product_definition (see 5.2.4.415).

The data associated with an Ee_product_definition are the following:

— cad_filename;

— context_description;

— creation_date;

— creator;

— discipline_id;

— documentation;

— product_definition_approval;

— product_definition_id;

— security_code;

— version.

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

4.2.278.1 cad_filename

The cad_filename specifies the name of the file or data repository that contains the detailed Ee_product_-definition in a computer aided design system. The reference is interpreted to be to an external definition of the details of the Ee_product_definition that is meaningful only within the organization that designed the product. The cad_filename need not be specified for a particular Ee_product_definition.

NOTE The data contained in the cad_filename may include more information to allow the enterprise to identify the originating system in addition to a simple name.

EXAMPLE 1 As an example, the following information may be included: operating system supplier name = "xxx", operating system name = "xxx", operating system version = "xxx", cad tool supplier name = "xxx", cad tool name = "xxx", cad tool version = "xxx", cad filename = "xxx", cad filename date stamp ="xxx" where "xxx" is the value information.

4.2.278.2 context_description

The context_description specifies the Ee_text (see 4.2.293) that is the purpose for a particular definition of the Ee_product_definition.

4.2.278.3 creation_date

The creation_date specifies the Date_and_time (see 4.2.175) at which the Ee_product_definition was first defined.

4.2.278.4 creator

The creator specifies the Person_and_organization (see 5.2.4.275) or the Organization (see 5.2.4.135) that initially created the Ee_product_definition. There shall be one or more Person_and_organization or Organization for an Ee_product_definition.

4.2.278.5 discipline_id

The discipline_id specifies the name of the discipline that creates the Ee_product_definition.

EXAMPLE 1 Typical usage may include one of the following as the last item in a comma separated list: analysis, synthesis.

4.2.278.6 documentation

The documentation specifies the role of the Ee_document (see 4.2.271) for the Ee_product_definition. The documentation need not be specified for a particular Ee_product_definition. There may be more than one Ee_document for an Ee_product_definition.

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4.2.278.7 product_definition_approval

The product_definition_approval specifies the role of an Ee_approval (see 4.2.269) for the Ee_product_-definition.

4.2.278.8 product_definition_id

The product_definition_id specifies the name used for identification of the Ee_product_definition so that users of the information can reference it.

4.2.278.9 security_code

The security_code specifies the role of the Security_classification (see 4.2.642) for the Ee_product_-definition.

4.2.278.10 version

The version specifies the role of the Ee_product_version (see 4.2.282) for the Ee_product_definition.

Constraints:

UR1: The combination of the product_definition_id and the version shall be unique within a population of Ee_product_definitions.

UR2: The combination of the discipline_id and the version shall be unique within a population of Ee_-product_definitions.

4.2.279 Ee_product_model

An Ee_product_model is a type of Managed_design_object (see 4.2.431). An Ee_product_model is the nomenclature that an enterprise marketing function assigns for purposes of communication with customers.

The data associated with an Ee_product_model are the following:

— model_name.

4.2.279.1 model_name

The model_name specifies the Ee_text (see 4.2.293) identifier of the Ee_product_model.

Constraints:

UR1: The model_name shall be unique within a population of Ee_product_models.

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4.2.280 Ee_product_related_product_category

An Ee_product_related_product_category is a type of Ee_product_category (see 4.2.275). An Ee_product_related_product_category relates one or more products to the specific characteristics associated with the category.

The data associated with an Ee_product_related_product_category are the following:

— of_product.

4.2.280.1 of_product

The of_product specifies the Ee_product (see 4.2.274) assigned to this Ee_product_related_product_category. There shall be one or more Ee_product for an Ee_product_related_product_category.

4.2.281 Ee_product_specific_parameter_value_assignment

An Ee_product_specific_parameter_value_assignment is a type of Managed_design_object (see 4.2.431). An Ee_product_specific_parameter_value_assignment is the assignment of a specific value to a specific characteristic of an Ee_product_category for a specific product.

The data associated with an Ee_product_specific_parameter_value_assignment are the following:

— assigned_parameter;

— associated_product_category;

— of_product.

4.2.281.1 assigned_parameter

The assigned_parameter specifies the Parameter_assignment (see 4.2.487) that is assigning the specific value for this Ee_product_specific_parameter_value_assignment.

4.2.281.2 associated_product_category

The associated_product_category specifies the Ee_product_related_product_category (see 4.2.280) that includes the characteristic being assigned a value with this Ee_product_specific_parameter_value_assignment.

4.2.281.3 of_product

The of_product specifies the Ee_product (see 4.2.274) assigned a characteristic value by this Ee_product_specific_parameter_value_assignment.

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Constraints:

WR1: Each Model_parameter in the role of assigned_parameter.assigned_parameter shall be in the role of category_parameter for the Ee_product_related_product_category specified by associated_product_-category.

WR2: Each Ee_product in the role of of_product shall be in the role of of_product for the Ee_product_-related_product_category specified by associated_product_category.

4.2.282 Ee_product_version

An Ee_product_version is a type of Managed_design_object (see 4.2.431). An Ee_product_version is the identification of the representation of a product after its design has reached a point of control or has undergone a formal release or change.

The data associated with an Ee_product_version are the following:

— authorizing_agreement;

— creator;

— design_supplier;

— product_definition;

— product_supplier;

— product_version_approval;

— life_cycle_status;

— revision_code;

— security_code;

— versioned_item.

4.2.282.1 authorizing_agreement

The authorizing_agreement specifies the role of the Contract (see 4.2.159) for the Ee_product_version. The authorizing_agreement need not be provided for a specific Ee_product_version.

4.2.282.2 creator

The creator specifies the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) responsible for the Ee_product_version.

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4.2.282.3 design_supplier

The design_supplier specifies either the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) that supplies the design of the Ee_product_version. The design_supplier need not be provided for a specific Ee_product_version.

4.2.282.4 product_definition

The product_definition is an inverse relationship that specifies that the existence of the Ee_product_version is dependent on the existence of the Ee_product_definition (see 5.2.4.143) that specifies the Ee_product_version as its version. There shall be one or more Ee_product_definition for an Ee_product_version.

4.2.282.5 product_supplier

The product_supplier specifies either the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) that supplies the Ee_product (see 4.2.274) of the Ee_product_version. The product_supplier need not be provided for a specific Ee_product_version.

4.2.282.6 product_version_approval

The product_version_approval specifies the Ee_approval (see 4.2.269) associated with the Ee_product_version.

4.2.282.7 life_cycle_status

The life_cycle_status specifies the stage of the Ee_product_version with respect to the design life cycle. The possibilities are conceptual, preliminary, detailed and final. The interpretation of these terms is enterprise and exchange partner specific, except that final shall be interpreted as released when the corresponding approval_status is approved.

4.2.282.8 revision_code

The revision_code specifies the string identifying an Ee_product_version.

4.2.282.9 security_code

The security_code specifies the Security_classification (see 4.2.642) of an Ee_product_version and is used to control access to design and other information about the Ee_product_version.

4.2.282.10 versioned_item

The versioned_item specifies the Ee_product (see 4.2.274) of which the Ee_product_version identifies the version.

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Constraints:

UR1: The combination of the versioned_item and the revision_code shall be unique within a population of Ee_product_versions.

WR1: At least one of design_supplier, product_supplier shall be provided.

4.2.283 Ee_requirement_occurrence

An Ee_requirement_occurrence is a type of Managed_design_object (see 4.2.431). An Ee_requirement_-occurrence may be a Requirement_group_occurrence (see 5.2.4.331), and additionally may be one of a Constraint_occurrence (see 5.2.4.116), a Design_characteristic_occurrence (see 5.2.4.298), a Design_-requirement_occurrence (see 5.2.4.175) or a Purpose_occurrence (see 5.2.4.332) and additionally may be one of an Electrical_requirement_occurrence (see 5.2.4.3), an Electromagnetic_requirement_occurrence (see 5.2.4.4) or a Thermal_requirement_occurrence (see 5.2.4.21), and additionally may be one of an Item_restricted_requirement_occurrence (see 5.2.4.9) or a Layout_spacing_requirement_occurrence (see 5.2.4.42). An Ee_requirement_occurrence is a statement of criteria for design that may be derived from more abstract criteria or may be a decomposition of a technical parameter associated wtih a product structure. Complex requirements may be associated with a product specifically for the purpose of managing the requirements. This relationship is not depicted in the diagram for Ee_requirement_occurrence.

NOTE This part of ISO 10303 provides generic categories for enterprise classification of requirements and includes some domain classified requirements.

The data associated with an Ee_requirement_occurrence are the following:

— analytical_requirement_representation;

— description;

— name;

— hierarchy_context;

— required_characteristic;

— required_coordinated_characteristic;

— required_material;

— required_part;

— required_specification;

— requirement_specification.

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4.2.283.1 analytical_requirement_representation

The analytical_requirement_representation specifies the role of the Analytical_representation for the Ee_requirement_occurrence. There may be more than one Analytical_representation for an Ee_requirement_occurrence. The analytical_requirement_representation need not be specified for a particular Ee_requirement_occurrence.

4.2.283.2 description

The description specifies the Ee_text (see 4.2.293) of details of the Ee_requirement_occurrence in a natural language. The description need not be specified for a particular Ee_requirement_occurrence.

4.2.283.3 name

The name specifies the unique string that identifies the Ee_requirement_occurrence.

NOTE The name should include information identifying the source of the requirement.

4.2.283.4 hierarchy_context

The hierarchy_context is an inverse relationship that specifies the Requirement_composition (see 5.2.4.49) that specifies the Ee_requirement_occurrence as its element. There shall be no more than one Requirement_composition for an Ee_requirement_occurrence.

4.2.283.5 required_characteristic

The required_characteristic specifies the role of the Characteristic (see 4.2.77) for the Ee_requirement_occurrence. The required_characteristic need not be specified for a particular Ee_requirement_occurrence. There may be more than one Characteristic for an Ee_requirement_occurrence.

4.2.283.6 required_coordinated_characteristic

The required_coordinated_characteristic specifies the role of the Coordinated_characteristic (see 5.2.4.383) for an Ee_requirement_occurrence. The required_coordinated_characteristic need not be specified for a particular Ee_requirement_occurrence. There may be more than one Coordinated_characteristic for an Ee_requirement_occurrence.

4.2.283.7 required_material

The required_material specifies the role of the Ee_material (see 4.2.273) for the Ee_requirement_occurrence. The required_material need not be specified for a particular Ee_requirement_occurrence.

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4.2.283.8 required_part

The required_part specifies the role of the Ee_product (see 4.2.274) for the Ee_requirement_occurrence. The required_part need not be specified for a particular Ee_requirement_occurrence. There may be more than one Ee_product for an Ee_requirement_occurrence.

4.2.283.9 required_specification

The required_specification specifies the Ee_specification (see 4.2.292) referenced by the Ee_requirement_occurrence. The required_specification need not be specified for a particular Ee_requirement_occurrence. There may be more than one Ee_specification for an Ee_requirement_occurrence.

4.2.283.10 requirement_specification

The requirement_specification specifies the Ee_specification (see 4.2.292) for the source of the Ee_requirement_occurrence. There shall be one or more Ee_specification for an Ee_requirement_occurrence.

Constraints:

UR1: The name shall be unique within a population of Ee_requirement_occurrence.

WR1: At least one of the following shall be provided: required_specification, required_part, required_coordinated_characteristic, required_characteristic, or required_material description.

4.2.284 Ee_rule

An Ee_rule is a type of Library_item (see 5.2.4.52). An Ee_rule is a constraint that may be levied in the design of an Ee_product (see 4.2.274). The constraint may be associated as a requirement on parameters of a design to achieve a desired characteristic or behaviour in the design. To achieve uniformity across designs, the Ee_rule is maintained under configuration control in a controlled environment such as a CAE or CAD library.

The data associated with an Ee_rule are the following:

— rule_description;

— version.

4.2.284.1 rule_description

The rule_description specifies the human-interpretable description of the constraint that a member of Ee_rule may levy on a design.

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4.2.284.2 version

The version is an inverse relationship that specifies that the existence of the Ee_rule is dependent on the existence of the Ee_rule_version (see 5.2.4.234) that specifies the Ee_rule as its configuration_-managed_rule. There shall be one or more Ee_rule_version for an Ee_rule.

Constraints:

UR1: The combination of the item_name inherited from Library_item and the library inherited from Library_item shall be unique within a population of Ee_rule.

WR1: The attribute item_version inherited from Library_item shall not be provided.

4.2.285 Ee_rule_complex_clause

The Ee_rule_complex_clause is a type of Managed_design_object (see 4.2.431). An Ee_rule_complex_-clause consist of one or more simple clauses that are ANDed together. The AND operator is provided by the SET aggregation in this application object.

The data associated with an Ee_rule_complex_clause are the following:

— conjunctive_content;

— identifier.

4.2.285.1 conjunctive_content

The conjunctive_content specifies specifies the Ee_rule_simple_clause (see 5.2.4.54) for the Ee_rule_-complex_clause. There shall be one or more conjunctive_content specified for an Ee_rule_complex_-clause.

4.2.285.2 identifier

The identifier specifies the name for the Ee_rule_complex_clause.

Constraints:

UR1: The identifier shall be unique within a population of Ee_rule_complex_clause.

4.2.286 Ee_rule_conclusion_definition

An Ee_rule_conclusion_definition is a type of Managed_design_object (see 4.2.431). An Ee_rule_-conclusion_definition provides the conclusion part of a rule construct.

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The data associated with an Ee_rule_conclusion_definition are the following:

— rule_definition;

— identifier;

— conjunctive_content.

4.2.286.1 rule_definition

The rule_definition specifies the Ee_rule_definition (see 5.2.4.84) for the Ee_rule_conclusion_definition. The rule_definition is the rule being composed by this Ee_rule_conclusion_definition.

4.2.286.2 identifier

The identifier specifies the name for the Ee_rule_conclusion_definition.

4.2.286.3 conjunctive_content

The conjunctive_content specifies specifies the Ee_rule_simple_clause for the Ee_rule_conclusion_definition. There shall be one or more conjunctive_content specified for an Ee_rule_conclusion_definition.

Constraints:

UR1: The combination of the rule_definition and the identifier shall be unique within a population of Ee_rule_conclusion_definition.

4.2.287 Ee_rule_definition

An Ee_rule_definition is a type of Managed_design_object (see 4.2.431). An Ee_rule_definition is a formal specification that defines a constraint by relating two elements based upon characteristics of a design, one as premise and one as conclusion. The Ee_rule_definition is for one version of a rule only.

The data associated with an Ee_rule_definition are the following:

— conclusion;

— defined_versioned_rule;

— identifier;

— premise.

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4.2.287.1 conclusion

The conclusion specifies the role of the ee_rule_conclusion_definition for the Ee_rule_definition.

4.2.287.2 defined_versioned_rule

The defined_versioned_rule specifies role of the Ee_rule_version (see 5.2.4.234) for the Ee_rule_definition.

4.2.287.3 identifier

The identifier specifies the name for Ee_rule_definition.

4.2.287.4 premise

The premise specifies the role of the ee_rule_premise_definition for the Ee_rule_definition.

Constraints:

UR1: The combination of defined_versioned_rule and identifier shall be unique within a population of Ee_rule_definitions.

4.2.288 Ee_rule_function

An Ee_rule_function is a type of Managed_design_object (see 4.2.431). An Ee_rule_function is a formal specification for a process that includes the source code and instance values for the process. An Ee_rule_function has a unique combination of identifier and reference_document. An Ee_rule_function shall have at least one parameter.

NOTE Source code is the computer-interpretable expressions that form a part of the Ee_rule_function. The attribute source_code is the relationship of these expressions to the Ee_rule_function.

The data associated with an Ee_rule_function are the following:

— identifier;

— parameter;

— reference_document;

— source_code.

4.2.288.1 identifier

The identifier specifies the name for the Ee_rule_function.

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4.2.288.2 parameter

The parameter specifies the role of the Model_parameter (see 4.2.451) for an Ee_rule_function. There shall be one or more Model_parameter specified for a particular Ee_rule_function.

4.2.288.3 reference_document

The reference_document specifies the role of the Ee_document (see 4.2.271) for an Ee_rule_function.

4.2.288.4 source_code

The source_code specifies the role of the Ee_specification (see 4.2.292) for an Ee_rule_function.

Constraints:

UR1: The combination of the identifier and the reference_document shall be unique within a population of Ee_rule_functions.

4.2.289 Ee_rule_premise_definition

The Ee_rule_premise_definition is a type of Managed_design_object (see 4.2.431). An Ee_rule_premise_-definition is the premise for a rule construct. The Ee_rule_premise_definition uses an 'OR' construct so that if any of the parts of the premise are true, the rule will fire.

The data associated with an Ee_rule_premise_definition are the following:

— rule_definition;

— identifier;

— disjunctive_content.

4.2.289.1 rule_definition

The rule_definition specifies the Ee_rule_definition (see 5.2.4.84) for the Ee_rule_premise_definition. The rule_definition is the Ee_rule_definition this Ee_rule_premise_definition is helping to compose.

4.2.289.2 identifier

The identifier specifies the name for the Ee_rule_premise_definition.

4.2.289.3 disjunctive_content

The disjunctive_content specifies an Ee_rule_complex_clause (see 5.2.4.53). There shall be one or more disjunctive_content specified for an Ee_rule_premise_definition.

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Constraints:

UR1: The combination of rule_definition and identifier shall be unique within a population of Ee_rule_-conclusion_definition.

4.2.290 Ee_rule_simple_clause

The Ee_rule_simple_clause is a type of Managed_design_object (see 4.2.431). An Ee_rule_simple_-clause assigns data specific to the rule definition to the generic algorithm specified by rule_function.

NOTE This data is not product instance data, but is categorical data helping to compose this definition.

EXAMPLE 1 An example of this type of data would be "all tracks less than 5 mils."

The data associated with an Ee_rule_simple_clause are the following:

— rule_function;

— parameters;

— identifier.

4.2.290.1 rule_function

The rule_function specifies the Ee_rule_definition (see 5.2.4.84) of the Ee_rule_simple_clause. The rule_function is the rule to which the Ee_simple_clause is assigning parameters.

4.2.290.2 parameters

The parameters specifies the Parameter_assignment (see 4.2.487) for an Ee_rule_simple_clause. There shall be one or more parameters specified for an Ee_rule_simple_clause.

4.2.290.3 identifier

The identifier specifies the name for the Ee_rule_simple_clause.

Constraints:

UR1: The identifier shall be unique within a population of Ee_rule_simple_clause.

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4.2.291 Ee_rule_version

An Ee_rule_version is a type of Managed_design_object (see 4.2.431). An Ee_rule_version is the management of the assignment of Ee_rule_definition (see 5.2.4.84) to Ee_rule (see 5.2.4.51). An Ee_rule may evolve with usage for any number of reasons. Each new Ee_rule_definition results in a new version of the rule. Every Ee_rule_version shall have a unique identifier in conjunction with identifier of the rule that it is configuration managing, a rule definition, and one or more management action.

The data associated with an Ee_rule_version are the following:

— configuration_managed_rule;

— management_action;

— source;

— version_identifier.

4.2.291.1 configuration_managed_rule

The configuration_managed_rule specifies the Ee_rule (see 5.2.4.51) that is being configuration managed for the Ee_rule_version.

4.2.291.2 management_action

The management_action is an inverse relationship that specifies that the existence of the Ee_rule_version is dependent on the existence of the Rule_action (see 5.2.4.92) that specifies the Ee_rule_version as its subject_rule. There shall be one or more Rule_action for an Ee_rule_version.

4.2.291.3 source

The source specifies either an Ee_document (see 4.2.271) or an Organization (see 5.2.4.135) for the origin for the Ee_rule_version. The source need not be specified for a particular Ee_rule_version.

4.2.291.4 version_identifier

The version_identifier specifies the string that uniquely identifies the Ee_rule_version in conjunction with the Ee_rule (see 5.2.4.51).

Constraints:

UR1: The combination of the configuration_managed_rule and the version_identifier shall be unique within a population of Ee_rule_versions.

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4.2.292 Ee_specification

An Ee_specification is a type of Ee_document (see 4.2.271). An Ee_specification may be either a Design_specification (see 5.2.4.177), a Language_reference_manual (see 4.2.414), a Material_specification (see 5.2.4.93), a Process_specification (see 4.2.589), or a Test_specification (see 5.2.4.94).

The data associated with an Ee_specification are the following:

— code_or_identifier;

— source.

4.2.292.1 code_or_identifier

The code_or_identifier specifies the string for the name to use in identifying a particular Ee_specification in the user's own terms. The code_or_identifier need not be specified for a particular Ee_specification.

4.2.292.2 source

The source specifies the Organization (see 5.2.4.135) or the Person_and_organization (see 5.2.4.275) responsible for the information of an Ee_specification.

4.2.293 Ee_text

An Ee_text is a type of Managed_design_object (see 4.2.431). An Ee_text is a string used to convey information.

The data associated with an Ee_text are the following:

— content.

4.2.293.1 content

The content specifies the organized list of one or more words that comprise a message.

4.2.294 Electrical_isolation_removal_structure

An Electrical_isolation_removal_structure is a type of Filled_area_material_removal_structure (see 5.2.4.101) that has specific materials removed from specific subsets of the filled area for the purpose of electrical isolation.

The data associated with an Electrical_isolation_removal_structure are the following:

— electrical_isolation_spacing_requirement.

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4.2.294.1 electrical_isolation_spacing_requirement

The electrical_isolation_spacing_requirement specifies the Ee_requirement_occurrence (see 4.2.283) of electrical isolation for the Electrical_isolation_removal_structure.

4.2.295 Electrical_network_definition

An Electrical_network_definition is a type of Functional_unit_network_definition (see 5.2.4.339) that identifes that the nodes in the network definition default to voltage as the nodal property.

4.2.296 Electrical_requirement_occurrence

An Electrical_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that is related to performance with respect to electrical functionality. An Electrical_requirement_occurrence may be a Material_electrical_conductivity_requirement_occurrence (see 5.2.4.103).

4.2.297 Electromagnetic_compatibility_requirement_allocation

An Electromagnetic_compatibility_requirement_allocation is a type of Assembly_requirement_allocation (see 4.2.40). An Electromagnetic_compatibility_requirement_allocation may be a Shield_allocation (see 5.2.4.137).

4.2.298 Electromagnetic_requirement_occurrence

An Electromagnetic_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that is related to performance with respect to electromagnetic compatibility and interference.

4.2.299 Engineering_make_from

An Engineering_make_from is a type of Managed_design_object (see 4.2.431). An Engineering_make_-from is the relationship between two products in which one product is used as the basis for the design of the other product.

EXAMPLE 1 Engineering_make_from may be mask programmed processors, enterprise programmed digital devices, or field programmable or field reprogramable arrays or modems that are updateable by downloading new firmware from a central source.

NOTE This facility is not limited to packaged parts but may be applied to any product.

EXAMPLE 2 A mask programmed processor would be a 'mask programmable processor' before programming and would be a 'Yaw rate processor' after programming.

The data associated with an Engineering_make_from are the following:

— base_design;

— resultant_design.

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4.2.299.1 base_design

The base_design specifies the Ee_product_definition (see 5.2.4.143) to be used as the basis for the design of another Ee_product (see 4.2.274) for the Engineering_make_from.

4.2.299.2 resultant_design

The resultant_design specifies the Ee_product_definition (see 5.2.4.143) that results from basing the design upon the design of another Ee_product (see 4.2.274) for the Engineering_make_from.

4.2.300 Equivalent_functional_terminals_assignment

An Equivalent_functional_terminals_assignment is a type of Managed_design_object (see 4.2.431). An Equivalent_functional_terminals_assignment is the assignment that a set of terminals are equivalent in a Functional_unit_usage_view (see 4.2.347).

The data associated with an Equivalent_functional_terminals_assignment are the following:

— equivalent_terminals;

— name.

4.2.300.1 equivalent_terminals

The equivalent_terminals specify the equivalent Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for the Equivalent_functional_terminals_assignment. There shall be at least two Functional_-unit_usage_view_terminal_definition for the Equivalent_functional_terminals_assignment.

4.2.300.2 name

The name specifies the string that is the identifier for the Equivalent_functional_terminals_assignment.

Constraints:

WR1: One member of equivalent_functional_terminals_assignment shall establish equivalency only between members of functional_unit_usage_view_terminal_definition that are terminals of the same functional_unit_definition.

4.2.301 Equivalent_functional_unit_definition_assignment

An Equivalent_functional_unit_definition_assignment is a type of Managed_design_object (see 4.2.431). An Equivalent_functional_unit_definition_assignment is the association between at least two Functional_-unit_definition (see 5.2.4.305) that are equivalent.

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The data associated with an Equivalent_functional_unit_definition_assignment are the following:

— equivalent_functional_unit_definitions;

— name.

4.2.301.1 equivalent_functional_unit_definitions

The equivalent_functional_unit_definitions specify the Functional_unit_definition (see 5.2.4.305) for the Equivalent_functional_unit_definition_assignment. There shall be at least two but may be more than two Functional_unit_definition for the Equivalent_functional_unit_definition_assignment.

4.2.301.2 name

The name specifies the string that is the identifier for the Equivalent_functional_unit_definition_assignment.

4.2.302 Evaluated_characteristic

An Evaluated_characteristic is a type of Managed_design_object (see 4.2.431). The Evaluated_characteristic provides a mechanism to validate or evaluate a Planned_characteristic (see 5.2.4.181).

The data associated with an Evaluated_characteristic are the following:

— evaluated_product_data;

— product_characterization_data;

— product_data_status.

4.2.302.1 evaluated_product_data

The evaluated_product_data specifies the Planned_characteristic (see 5.2.4.181) for an Evaluated_characteristic.

4.2.302.2 product_characterization_data

The product_characterization_data specifies one or more Coordinated_characteristic (see 5.2.4.383) for an Evaluated_characteristic. The product_characterization_data need not be provided for a specific Evaluated_characteristic.

4.2.302.3 product_data_status

The product_data_status provides a status of valid, invalid, not_evaluatable, or to_be_evaluated for an Evaluated_characteristic.

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4.2.303 Explicitly_located_layer_connection_point

An Explicitly_located_layer_connection_point is a type of Layer_connection_point (see 5.2.4.420) that is not a Dependently_located_layer_connection_point (see 5.2.4.157). An Explicitly_located_layer_connection_point may be referenced by a Junction_vertex_allocation to help define a topological structure.

EXAMPLE 1 Figure 5.2.4.201 illustrates a detail of a layout drawing that shows the Explicitly_located_layer_-connection_points that are included in the design due to internal layout considerations.

The data associated with an Explicitly_located_layer_connection_point are the following:

— location.

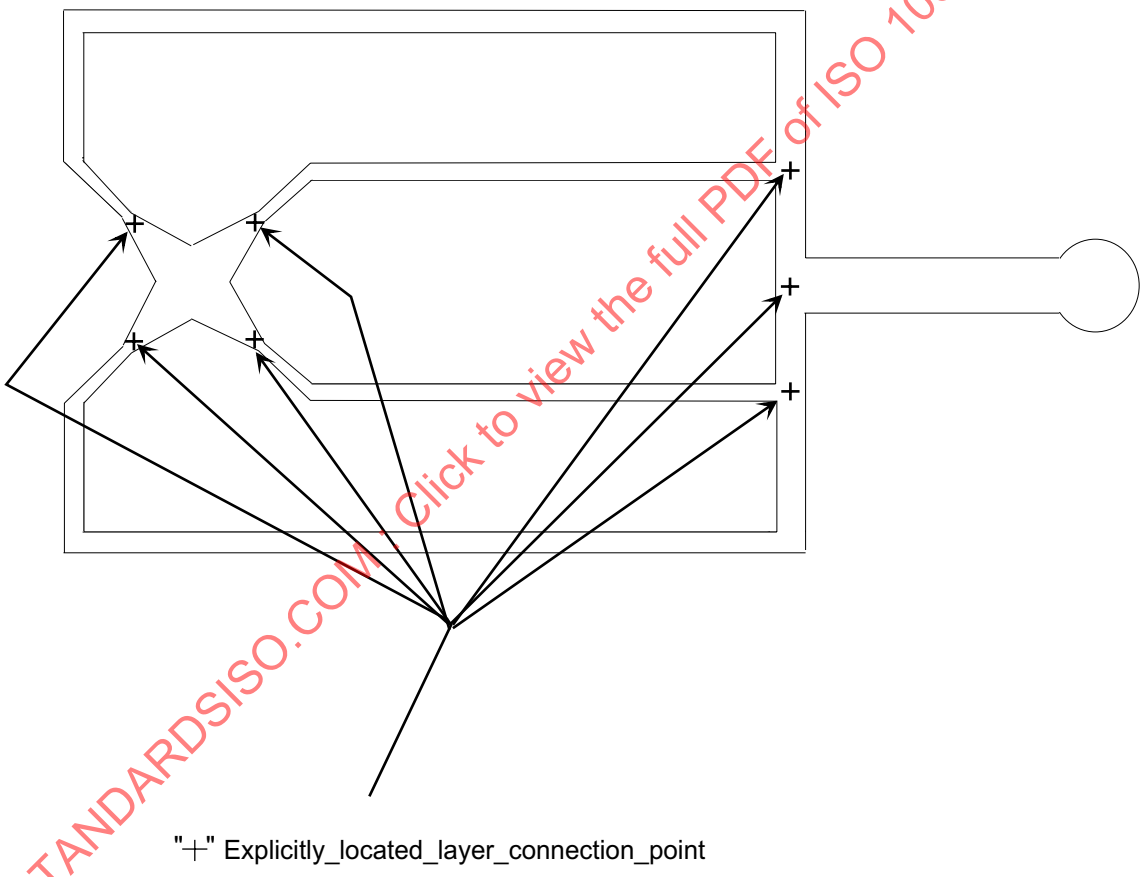

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Figure 43 – Explicitly_located_layer_connection_point

4.2.303.1 location

The location specifies the Cartesian_point (see 4.2.67) relative to the Cartesian_point origin of the Interconnect_module (see 4.2.372) at which the Explicitly_located_layer_connection_point resides.

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Constraints:

UR1: The combination of location, and resident_design_layer_stratum inherited from the supertype Layer_connection_point shall be unique within a population of Explicitly_located_layer_connection_-point.

WR1: The location shall be in the extent of the resident_design_layer_stratum.

4.2.304 External_definition

An External_definition is a type of Managed_design_object (see 4.2.431). An External_definition is a definition that is supported externally to this part of ISO 10303.

The data associated with an External_definition are the following:

— code;

— code_value;

— reference_document.

4.2.304.1 code

The code specifies the string as the identifier of the type of the External_definition.

4.2.304.2 code_value

The code_value specifies the text as the content of the External_definition.

4.2.304.3 reference_document

The reference_document specifies either the Ee_document (see 4.2.271) or a string referred to as a standard document identification string, registered by IEC or ISO for the purpose of unambiguously identifying a document published by the respective organization, as the code definition document used by application programmers for the External_definition.

NOTE The reference_document includes a data dictionary that defines the allowed types that may be used as identifiers.

Constraints:

IP1: The string specified by code shall not appear more than once in the reference_document. This constraint is to be interpreted as a requirement against the implementation of document when that implementation is to support External_definition.

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4.2.305 Externally_defined_curve_font

An Externally_defined_curve_font is a type of Managed_design_object (see 4.2.431). An Externally_-defined_curve_font is a curve font that is defined in an external computer interpretable system.

4.2.306 Externally_defined_dimension_representation

An Externally_defined_dimension_representation is a type of Shape_dimension_representation (see 4.2.644) the interpretation of which is dependent on definitions supported externally to this part of ISO 10303.

The data associated with an Externally_defined_dimension_representation are the following:

— definitions;

— dimension_value.

4.2.306.1 definitions

The definitions specify the External_definition (see 4.2.304) that represents the Dimensional_characteristic (see 4.2.256). There shall be one or more External_definition specified as definitions for an Externally_defined_dimension_representation.

4.2.306.2 dimension_value

The dimension_value specifies the Data_element (see 4.2.173) that in conjunction with the External_-definition (see 4.2.304), that are specified as the definitions, represent the associated Dimensional_-characteristic (see 4.2.256). The dimension_value need not be specified for an Externally_defined_-dimension_representation.

EXAMPLE 1 The system of limits and fits specifies a way in which to represent dimensions and is defined in ISO 286.

4.2.307 Externally_defined_ee_product_definition

An Externally_defined_ee_product_definition is a type of Ee_product_definition (see 5.2.4.143) that is defined in an external computer interpretable system.

The data associated with an Externally_defined_ee_product_definition are the following:

— source.

4.2.307.1 source

The source specifies the name of the source of the Externally_defined_ee_product_definition.

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4.2.308 Externally_defined_hatch_style

An Externally_defined_hatch_style is a type of Managed_design_object (see 4.2.431). An Externally_-defined_hatch_style is a hatch style that is defined in an external computer interpretable system.

4.2.309 Externally_defined_tile

An Externally_defined_tile is a type of Managed_design_object (see 4.2.431). An Externally_defined_-tile is a tile that is defined in an external computer interpretable system.

4.2.310 Externally_defined_tile_style

An Externally_defined_tile_style is a type of Managed_design_object (see 4.2.431). An Externally_-defined_tile_style is a tile style that is defined in an external computer interpretable system.

4.2.311 Fabrication_joint

A Fabrication_joint is a type of Managed_design_object (see 4.2.431). A Fabrication_joint is a joint that is created in the fabrication of a Interconnect_module (see 4.2.372).

EXAMPLE 1 Figure 5.2.4.215 is a plan view of the construction of a Fabrication_joint between a Land (see 4.2.407) and a Conductive_interconnect_element (see 5.2.4.154) that results in a Conductor (see 5.2.4.162) segment. This figure illustrates the geometric relationship of the element terminals in the construction of the segment.

EXAMPLE 2 Figure 5.2.4.216 is a cross-sectional view of the construction of a Fabrication_joint between a Land and a Component_termination_passage (see 5.2.4.227).

The data associated with a Fabrication_joint are the following:

— auxiliary_joint_material;

— fabrication_features.

4.2.311.1 auxiliary_joint_material

The auxiliary_joint_material specifies the Stratum_feature_template_component (see 5.2.4.161) for the Fabrication_joint. The auxiliary_joint_material need not be specified for a particular Fabrication_joint.

4.2.311.2 fabrication_features

The fabrication_features specify exactly two from among the following: a Component_termination_passage_join_terminal, a Conductive_interconnect_element_terminal (see 5.2.4.11), a Land_join_terminal (see 5.2.4.12), a Non_functional_land_join_terminal (see 5.2.4.13), a Printed_component_join_terminal (see 5.2.4.109), or a Via_terminal (see 5.2.4.315) for the Fabrication_joint.

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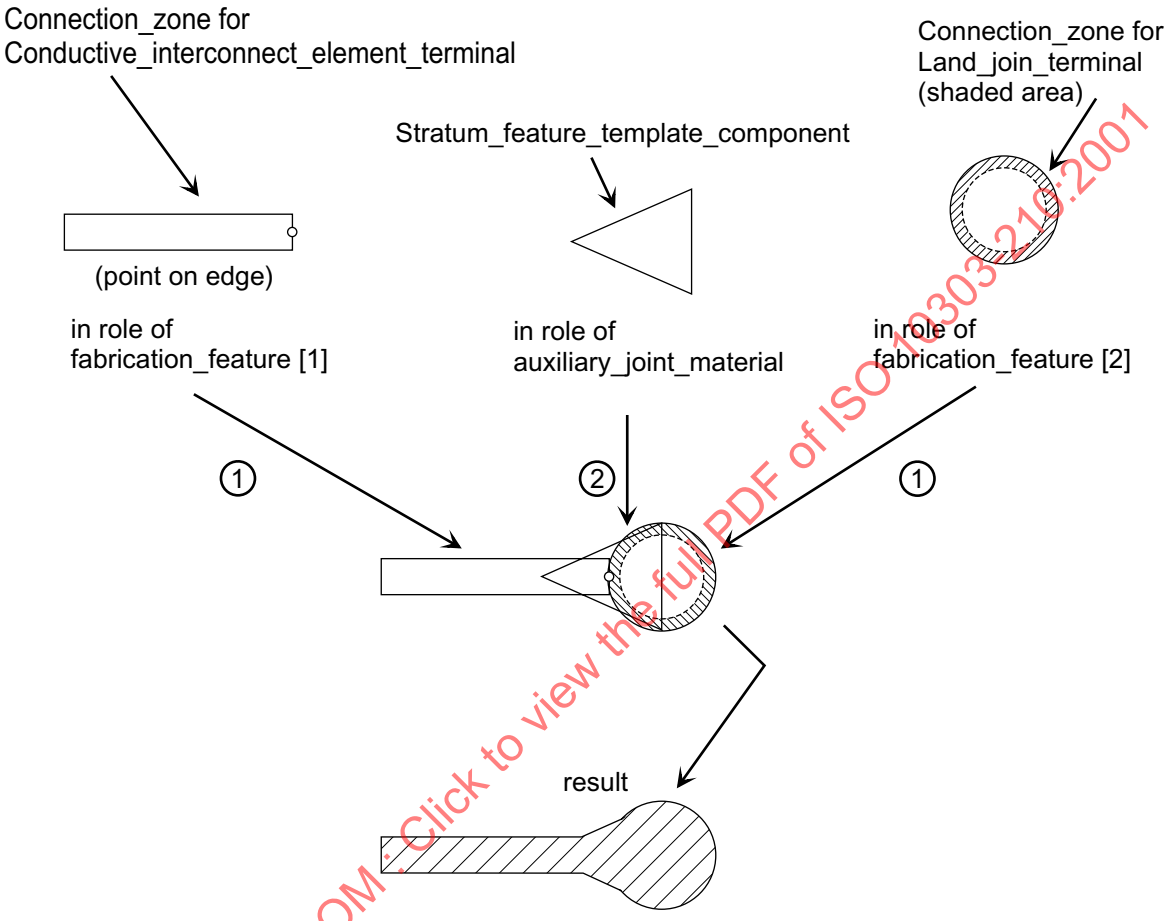

* Step 1 : relate 2 terminals (of already placed components)

* Step 2 : relate a Stratum_feature_template_component to the joint

Note : 1) This supports filleting and keyholing at the intersection of Land and trace Reference IPC-D-275.
2) The design view is the Interconnect_module.

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Figure 44 – Land to Conductive_interconnect_element Fabrication_joint exploded view

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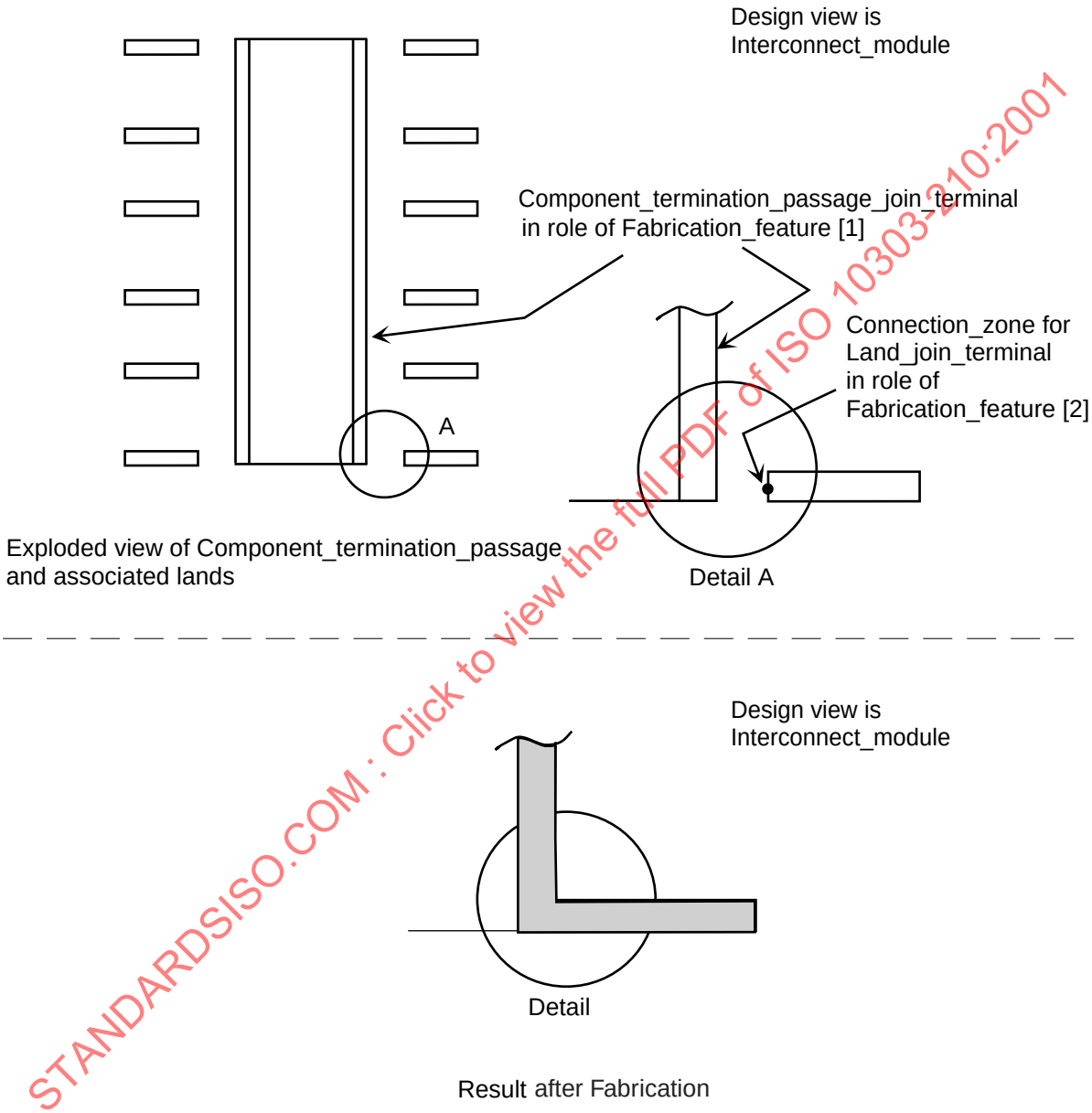

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Figure 45 – Land to Component_termination_passage exploded view

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Constraints:

WR1: A member of Conductive_interconnect_element_terminal and a member of Non_functional_land_join_terminal shall not be in the same set of fabrication_features.

4.2.312 Fabrication_technology_specification

A Fabrication_technology_specification is a type of Process_specification (see 4.2.589) that describes the technology used for parts and part families.

4.2.313 Feature_group_relationship

A Feature_group_relationship is a type of Managed_design_object (see 4.2.431). A Feature_group_relationship is the association of one or more Part_feature (see 4.2.494) and a Part_group_feature (see 5.2.4.247) that are used in the composition of that Part_group_feature.

The data associated with a Feature_group_relationship are the following:

— related_feature;

— relating_feature.

4.2.313.1 related_feature

The related_feature specifies the Part_feature (see 4.2.494) used in the Feature_group_relationship. There shall be one or more Part_feature for a Feature_group_relationship.

4.2.313.2 relating_feature

The relating_feature specifies the Part_group_feature (see 5.2.4.247) in the Feature_group_relationship.

4.2.314 Feature_shape_composition_relationship

A Feature_shape_composition_relationship is a type of Managed_design_object (see 4.2.431). A Feature_shape_composition_relationship is the association of a Feature_shape_occurrence (see 4.2.316) with its Axis_placement (see 4.2.43) to create a resultant Feature_shape_definition (see 4.2.315).

The data associated with a Feature_shape_composition_relationship are the following:

— related_feature_shape;

— related_feature_shape_placement;

— resultant_feature_shape.

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4.2.314.1 related_feature_shape

The related_feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Feature_shape_composition_relationship.

4.2.314.2 related_feature_shape_placement

The related_feature_shape_placement specifies the role of the Axis_placement (see 4.2.43) for the Feature_shape_composition_relationship.

4.2.314.3 resultant_feature_shape

The resultant_feature_shape specifies the role of the Feature_shape_definition (see 4.2.315) for the Feature_shape_composition_relationship.

4.2.315 Feature_shape_definition

A Feature_shape_definition is a type of Managed_design_object (see 4.2.431). A Feature_shape_definition is one of a Bound_volume_shape (see 4.2.58), a Curve (see 4.2.165), an Edge_based_2d_wireframe (see 5.2.4.230), a Geometrically_bounded_2d_wireframe (see 5.2.4.263), an Open_shell_based_surface (see 5.2.4.39), a< Internal.ref linkend="Planar_shape">, a Shell_based_2d_wireframe (see 5.2.4.264), or a Styled_text (see 5.2.4.270). A Feature_shape_definition is the aggregation of geometry elements that represents the shape of an object. The dimensionality of the geometric elements is determined by the dimensionality of the object being represented.

The data associated with a Feature_shape_definition are the following:

— geometric_context.

4.2.315.1 geometric_context

The geometric_context specifies the role of the Cartesian_coordinate_system (see 4.2.66) for the Feature_shape_definition.

4.2.316 Feature_shape_occurrence

A Feature_shape_occurrence is a type of Managed_design_object (see 4.2.431). A Feature_shape_occurrence is the instantiation of a Feature_shape_definition (see 4.2.315). The interpretation of this Application Object shall be that it specifies the location and orientation of the Feature_shape_definition in the context of another shape. This Application Object shall not be independently instantiated as it does not specify that other shape.

The data associated with a Feature_shape_occurrence are the following:

— instantiated_feature_shape.

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4.2.316.1 instantiated_feature_shape

The instantiated_feature_shape specifies the role of the Feature_shape_definition (see 4.2.315) for the Feature_shape_occurrence.

Constraints:

WR1: A particular instance of Feature_shape_occurrence shall not be referenced by more than one Part_feature within the same Physical_unit_usage_view

4.2.317 Fiducial

A Fiducial is a type of Laminate_component (see 4.2.404) that is a basis of measurement with respect to other Assembly_components. A Fiducial is used for accurate alignment of one item with another. Another type of Laminate_component may play the role of Fiducial in a design.

4.2.318 Fiducial_part_feature

A Fiducial_part_feature is a type of Part_tooling_feature (see 5.2.4.322). A Fiducial_part_feature identifies a feature for product alignment with respect to a tool.

4.2.319 Fiducial_stratum_feature

A Fiducial_stratum_feature is a type of Stratum_feature (see 4.2.683) that is a basis of measurement with respect to other Stratum_features. A Fiducial_stratum_feature is used for accurate alignment of one item with another. Another type of Stratum_feature may play the role of Fiducial_stratum_feature in a design.

4.2.320 Fill_area

A Fill_area is a type of Managed_design_object (see 4.2.431). A Fill_area is the area bounded by a Curve (see 4.2.165) that is defined to be filled with material using a pattern. Each Curve shall be an outer or inner boundary. Each boundary shall be closed. There shall be no more than one outer boundary. No boundary shall self-intersect or intersect with any other boundary.

NOTE This Application Object is describing geometric patterns. The association of material with the patterns occurs elsewhere, for instance in the Design_intent_modification_styled_area_representation (see 5.2.4.24).

The data associated with a Fill_area are the following:

— boundary.

4.2.320.1 boundary

The boundary specifies the Curve (see 4.2.165) that describes the outline of the Fill_area. There shall be one or more Curve for a Fill_area.

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4.2.321 Fill_area_occurrence

A Fill_area_occurrence is a type of Managed_design_object (see 4.2.431). A Fill_area_occurrence is an instantiation of a Fill_area (see 5.2.4.327). The boundary_style shall be applied to each boundary of the instance fo the Fill_area. A zero width boundary_style shall be interpreted as using the boundaries of the Fill_area as clipping regions. A non-zero width boundary_style shall be interpreted as the regularlized Boolean "OR" operation on the instance of the Fill_area, applied at each boundary after the clip operation required by the zero width boundary style. The orientation of the Fill_area instances shall be parallel with the orientation of the Fill_area.

The data associated with a Fill_area_occurrence are the following:

— boundary_style;

— filled_area;

— fill_style_target;

— style.

4.2.321.1 boundary_style

The boundary_style specifies the role of the Curve_style (see 5.2.4.253) for the Fill_area_occurrence. The boundary_style is applied to each instance of the Fill_area boundaries individually. The boundary_-style end parameters shall be ignored. The boundary_style curve_font shall not be specified.

4.2.321.2 filled_area

The filled_area specifies the role of the Fill_area (see 5.2.4.327) for the Fill_area_occurrence. The Fill_-area provides shape and orientation information for the Fill_area_occurrence.

4.2.321.3 fill_style_target

The fill_style_target specifies the Cartesian_point (see 4.2.67) that defines the location of the Fill_area_-style (see 5.2.4.328) for the Fill_area_occurrence.

4.2.321.4 style

The style specifies the role of the Fill_area_style (see 5.2.4.328) for the Fill_area_occurrence. There shall be one or more Fill_area_style for a Fill_area_occurrence.

4.2.322 Fill_area_style

A Fill_area_style is a type of Managed_design_object (see 4.2.431). A Fill_area_style is the selected style used in a Fill_area (see 5.2.4.327).

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The data associated with a Fill_area_style are the following:

— fill_style;

— name.

4.2.322.1 fill_style

The fill_style specifies either an Externally_defined_hatch_style (see 5.2.4.203), an Externally_defined_-tile_style (see 5.2.4.214), a Fill_area_style_hatching (see 5.2.4.329), a Fill_area_style_tile (see 5.2.4.335), or a Solid_fill_style (see 5.2.4.345) for the Fill_area_style.

4.2.322.2 name

The name specifies the string for the identifier for the Fill_area_style.

Constraints:

UR1: The name shall be unique within a population of Fill_area_style.

4.2.323 Fill_area_style_hatching

A Fill_area_style_hatching is a type of Managed_design_object (see 4.2.431). A Fill_area_style_hatching is the parallel line hatch style of a Fill_area (see 5.2.4.327). All units associated with Fill_area_style_-hatching are defined in the global units for the Interconnect_module (see 4.2.372) being designed. The geometric reference for Fill_area_style_hatching shall be the origin of the Interconnect_module being designed. When this Application Object is used to help compose a Design_intent_modification_styled_-area_representation (see 5.2.4.24) or to help compose a Stratum_feature_styled_area_representation (see 5.2.4.373), only the Curve_style_font (see 5.2.4.290) shall be referenced by the curve_font attribute of the Curve_style Application Object referenced by hatch_line_appearance.

NOTE In order to obtain cross-hatch, two instances of Fill_are_style_hatching are required, with complementary angles.

The data associated with a Fill_area_style_hatching are the following:

— hatch_line_angle;

— hatch_line_appearance;

— pattern_start;

— point_of_reference_hatch_line;

— start_of_next_hatch_line.

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4.2.323.1 hatch_line_angle

The hatch_line_angle specifies the role of the Angle_data_element (see 4.2.17) for the Fill_area_style_-hatching.

4.2.323.2 hatch_line_appearance

The hatch_line_appearance specifies the role of the Curve_style (see 5.2.4.253) for the Fill_area_style_-hatching.

NOTE The curve style may include a discontiguous geometric shape, in which case the hatch cannot be used to represent product data which is contiguous in nature.

EXAMPLE 1 The curve style may be a dashed line and in that case each of the dashes would correspond to a differenct Stratum_feature (see 4.2.683).

4.2.323.3 pattern_start

The pattern_start specifies the Cartesian_point (see 4.2.67) for the beginning of the pattern of Fill_area_-style_hatching.

4.2.323.4 point_of_reference_hatch_line

The point_of_reference_hatch_line specifies the Cartesian_point (see 4.2.67) for the point of reference and located on the initial hatch line for the Fill_area_style_hatching.

4.2.323.5 start_of_next_hatch_line

The start_of_next_hatch_line specifies the Vector (see 5.2.4.393) from the end Cartesian_point of the present hatch line to the beginning Cartesian_point of the next hatch line for the Fill_area_style_hatching.

4.2.324 Fill_area_style_tile

A Fill_area_style_tile is a type of Managed_design_object (see 4.2.431). A Fill_area_style_tile is the definition of the tile for a Fill_area_style (see 5.2.4.328).

The data associated with a Fill_area_style_tile are the following:

— tile;

— tiling_pattern;

— tiling_scale.

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4.2.324.1 tile

The tile specifies either an Externally_defined_tile (see 5.2.4.204), a Fill_area_style_tile_curve_with_-style (see 5.2.4.406), a Fill_area_style_tile_solid_region (see 5.2.4.405), or a Fill_area_style_tile_symbol_with_style (see 5.2.4.222) for the Fill_area_style_tile.

4.2.324.2 tiling_pattern

The tiling_pattern specifies two Vector (see 5.2.4.393) for the Fill_area_style_tile. There shall be exactly two Vector for a Fill_area_style_tile.

4.2.324.3 tiling_scale

The tiling_scale specifies the role of the Positive_ratio_measure (see 4.2.567) for a Fill_area_style_tile.

4.2.325 Fill_area_style_tile_curve_with_style

A Fill_area_style_tile_curve_with_style is a type of Managed_design_object (see 4.2.431). A Fill_-area_style_tile_curve_with_style is the definition of the tiling of a Fill_area (see 5.2.4.327).

4.2.326 Fill_area_style_tile_solid_region

A Fill_area_style_tile_solid_region is a type of Managed_design_object (see 4.2.431). A Fill_area_-style_tile_solid_region is the definition of a region that shall be filled solidly with tiles.

4.2.327 Fill_area_style_tile_symbol_with_style

A Fill_area_style_tile_symbol_with_style is a type of Managed_design_object (see 4.2.431). A Fill_-area_style_tile_symbol_with_style is the definition of a tile symbol with a specified style.

4.2.328 Filled_area_material_removal_structure

A Filled_area_material_removal_structure is a type of Material_removal_feature (see 5.2.4.418). A Filled_area_material_removal_structure is either an Electrical_isolation_removal_structure (see 5.2.4.100) or a Thermal_isolation_removal_structure (see 5.2.4.325).

The data associated with a Filled_area_material_removal_structure are the following:

— design_intent.

4.2.328.1 design_intent

The design_intent specifies the Conductive_filled_area (see 5.2.4.365) for the requirement for the Filled_-area_material_removal_structure.

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4.2.329 Flatness_tolerance

A Flatness_tolerance is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) that specifies or partially specifies the design requirement on the flatness of the Physical_feature_or_-part_template (see 4.2.527) to which the Flatness_tolerance is applied.

NOTE Flatness tolerance is defined in terms of tolerance zone definitions in 14.2 of ISO 1101.

Constraints:

WR1: The Shape_element specified by the toleranced_shape_element shall be a Physical_feature_or_-part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Flatness_tolerance shall not be a Geometric_tolerance_with_applied_material_condition_-property.

WR3: The Flatness_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_-with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_-specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_-size.

WR4: If the Flatness_tolerance specifies a Tolerance_zone_definition_with_per_unit_size_specification as the tolerance_zone_or_boundary_definition, there shall be exactly two Length_data_element specified as the per_unit_size by the Tolerance_zone_per_unit_size_specification that is specified as the per_unit_size_specification by the Tolerance_zone_definition_with_per_unit_size_specification.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a flatness tolerance is sensible.

4.2.330 Font_definition

A Font_definition is a type of Managed_design_object (see 4.2.431). A Font_definition is the definition of a font. Font support shall include outlines using glyphs, as well as font and font family.

NOTE 1 This description is intended to be a complete reference to a font definition. Items to be included are usually font size, aspect ratio, type, etc.

NOTE 2 Font_description supports Part_text_template.

4.2.331 Frozen_assignment

A Frozen_assignment is a type of Managed_design_object (see 4.2.431). A Frozen_assignment is the specification that one or more Frozen_design_object (see 5.2.4.23) must be unchanged during further design activity.

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The data associated with a Frozen_assignment are the following:

— assigned_approval;

— frozen_item.

4.2.331.1 assigned_approval

An assigned_approval specifies the role of the Ee_approval (see 4.2.269) for the Frozen_assignment.

4.2.331.2 frozen_item

The frozen_item specifies a Frozen_design_object (see 5.2.4.23) for which the design is to remain unchanged in the Frozen_assignment. There shall be one or more Frozen_design_object for a Frozen_assignment.

Constraints:

WR1: Each Frozen_assignment shall not be referenced by any Frozen_assignment.

4.2.332 Frozen_design_object

A Frozen_design_object is a type of Managed_design_object (see 4.2.431). A Frozen_design_object identifies the Managed_design_object which participates in the Frozen_assignment (see 5.2.4.389).

NOTE The purpose of Frozen_design_object is for approval of design aspects. The typical use is to freeze allocations between the functional and physical design aspects. This use includes gate swapping and terminal swapping.

Constraints:

IP1: Each member of Frozen_design_object shall not be a member of any of the following: Certification, Contract, Ee_approval, Ee_product_configuration, Ee_product_definition, Ee_product_version, Planned_effectivity, Security_classification, Supplied_product_version, Work_order, or Work_request.

4.2.333 Functional_specification

A Functional_specification is a type of Managed_design_object (see 4.2.431). A Functional_specification is the information that characterizes the behaviour of a Functional_unit (see 5.2.4.313) under controlled circumstances using stimulus-response test methods. Detailed properties of the relationship between the reference and characterizing signals define the behaviour.

NOTE The evaluation or categorization of this relationship is not standardized in this document.

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The data associated with a Functional_specification are the following:

— characteristic_category;

— characterizing_signal;

— reference_signal.

4.2.333.1 characteristic_category

The characteristic_category specifies the External_definition (see 4.2.304) of the category for the Functional_specification.

4.2.333.2 characterizing_signal

The characterizing_signal specifies the response Signal_specification (see 5.2.4.122) for the Functional_specification.

4.2.333.3 reference_signal

The reference_signal specifies the reference or stimulus Signal_specification (see 5.2.4.122) for the Functional_specification.

4.2.334 Functional_specification_to_requirement_occurrence_assignment

A Functional_specification_to_requirement_occurrence_assignment is a type of Managed_design_object (see 4.2.431). A Functional_specification_to_requirement_occurrence_assignment is the relationship between the Functional_specification (see 5.2.4.104) and the resulting Ee_requirement_occurrence (see 4.2.283).

The data associated with a Functional_specification_to_requirement_occurrence_assignment are the following:

— assigned_requirement_occurrence;

— specification_data.

4.2.334.1 assigned_requirement_occurrence

The assigned_requirement_occurrence specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Functional_specification_to_requirement_occurrence_assignment.

4.2.334.2 specification_data

The specification_data specifies the role of the Functional_specification (see 5.2.4.104) for the Functional_specification_to_requirement_occurrence_assignment.

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4.2.335 Functional_terminal_group

A Functional_terminal_group is a type of a Managed_design_object (see 4.2.431). A Functional_terminal_group is a group of terminals that have common characteristics and can be acted upon as a group.

The data associated with a Functional_terminal_group are the following:

— group_definition;

— group_type;

— name.

4.2.335.1 group_definition

The group_definition specifies the string that provides the meaning for the Functional_terminal_group.

4.2.335.2 group_type

The group_type specifies the string that is the class for the Functional_terminal_group.

4.2.335.3 name

The name specifies the string that is the identifier for the Functional_terminal_group.

Constraints:

UR1: The name shall be unique within a population of Functional_terminal_group.

4.2.336 Functional_terminal_group_assignment

A Functional_terminal_group_assignment is a type of Managed_design_object (see 4.2.431). A Functional_terminal_group_assignment allocates a Scalar_terminal_definiton to the Functional_terminal_group. This is the mechanism that provides members of the Functional_terminal_group.

The data associated with a Functional_terminal_group_assignment are the following:

— composed_group;

— functional_usage_view_terminal.

4.2.336.1 composed_group

The composed_group specifies the role of the Functional_terminal_group for the Functional_terminal_group_assignment. The composed_group specifies the group that the terminal is a member.

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4.2.336.2 functional_usage_view_terminal

The functional_usage_view_terminal specifies the role of the Scalar_terminal_defintion for the Functional_terminal_group_assignment. The functional_usage_view_terminal specifies the terminal that is a member of the group.

4.2.337 Functional_unit

A Functional_unit is a type of Managed_design_object (see 4.2.431). A Functional_unit is an occurrence of a Functional_unit_definition (see 5.2.4.305) in the composition of a Functional_unit_network_definition (see 5.2.4.339).

EXAMPLE 1 Figure 5.2.4.257 is a schematic of a network definition showing hierarchical relationships, as well as the usage view and network definition for a functional block.

The data associated with a Functional_unit are the following:

— access_mechanisms;

— composed_network;

— definition;

— functional_property;

— reference_designation.

4.2.337.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Functional_unit is dependent on the existence of the Functional_unit_terminal (see 5.2.4.267) that specifies the Functional_unit as its accessed_functional_unit. There shall be one or more Functional_unit_terminal for a Functional_unit.

4.2.337.2 composed_network

The composed_network specifies the role of the Functional_unit_network_definition (see 5.2.4.339) for the Functional_unit.

4.2.337.3 definition

The definition specifies the role of the Functional_unit_definition (see 5.2.4.305) for the Functional_unit.

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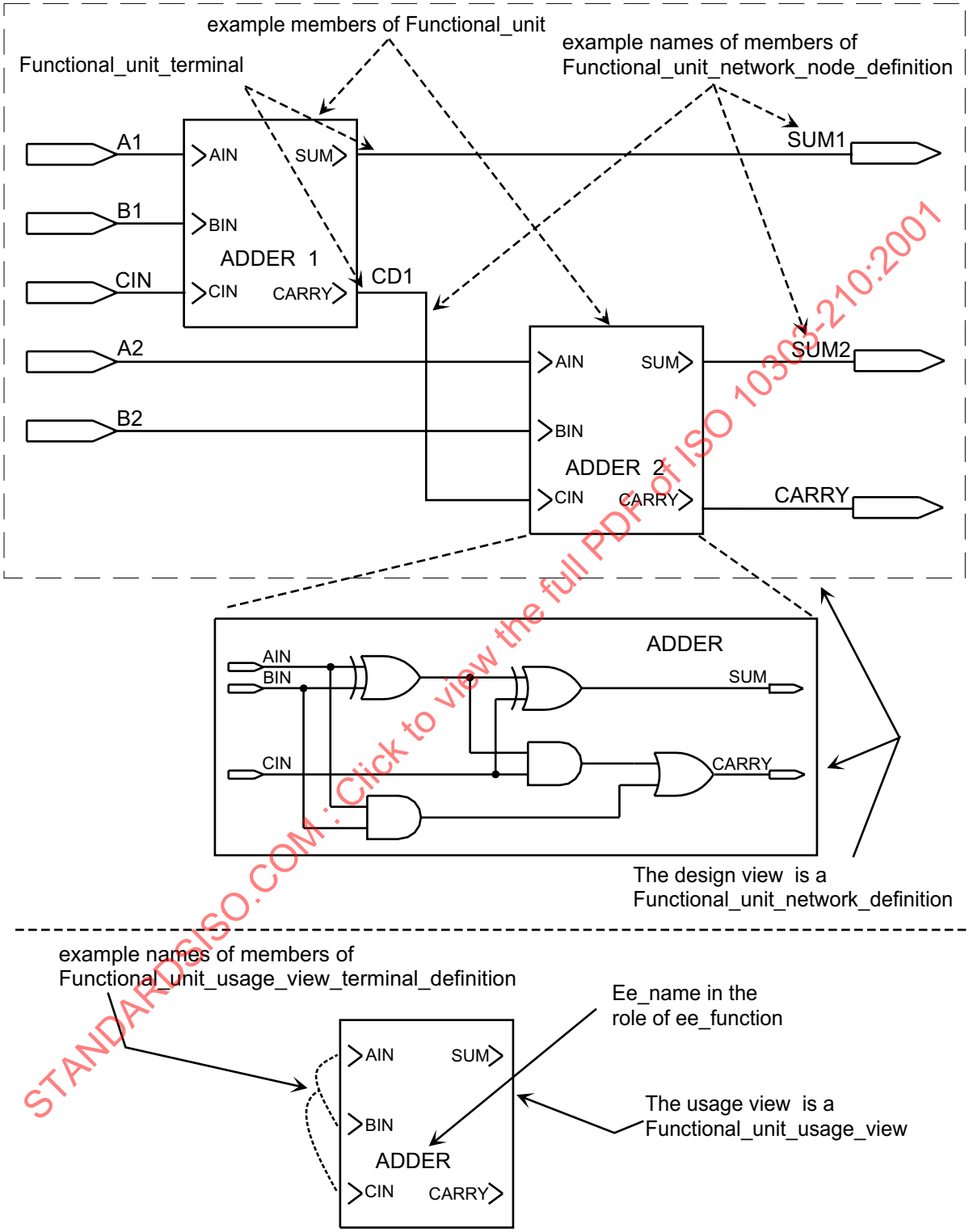

NOTE: This example ignores the difference between the symbol of something, and the thing itself, for presentation purposes.

Figure 46 – Schematic presentation of network definition with Functional_units

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4.2.337.4 functional_property

The functional_property specifies the role of the Characteristic (see 4.2.77) for the Functional_unit. There may be more than one Characteristic for the Functional_unit. The functional_property need not be provided for a particular Functional_unit. The functional_property shall be interpreted as overriding the properties supplied as Characteristic for the Functional_unit_definition in the role of definition when the type names of the Characteristics are identical.

4.2.337.5 reference_designation

The reference_designation specifies the name that identifies the Functional_unit, in the context of the Functional_unit_network_definition (see 5.2.4.339).

Constraints:

UR1: The combination of the reference_designation and the composed_network shall be unique within a population of Functional_units.

WR1: A network definition shall not define itself.

WR2: Considering the functional_unit_definition entities as nodes in a structural graph, and the functional_unit entity as the links of the graph, the graph thus composed shall be directed and acyclic.

NOTE A node that is a Functional_unit_definition may be a Functional_unit_network_definition.

4.2.338 Functional_unit_definition

A Functional_unit_definition is a type of Ee_product_definition (see 5.2.4.143). A Functional_unit_definition is one of a Functional_unit_network_definition (see 5.2.4.339), or a Functional_unit_usage_view (see 4.2.347). A Functional_unit_definition is the characterization of behaviour realized by one or more versions of a part or a product, or a subset of a product. This characterization is applicable to every occurrence of the element modelled.

NOTE This part of ISO 10303 explicitly supports requirements traceability from a functional definition to a physical definition by providing application objects with the semantics of a forward design flow (i.e., from functional definition to physical definition). In order to use the standard to exchange functional definitions created only to support analysis of existing physical definitions, it is necessary to populate the discipline_id attribute of the supertype Ee_product_definition. The discipline_id of Ee_product_definition specifies the usage of the Functional_unit_definition. Two possible values are "Analysis", "Synthesis". It may not be possible to correlate each Functional_unit to a corresponding Assembly_component when the value is "Analysis". The value of "Synthesis" is suggested when the purpose is not analysis.

The data associated with a Functional_unit_definition are the following:

— analytical_functional_unit_representation;

— ee_function.

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4.2.338.1 analytical_functional_unit_representation

The analytical_functional_unit_representation specifies the Analytical_representation (see 4.2.16) for the computer-interpretable model whose contents are not defined in this part of ISO 10303 for the Functional_unit_definition. The analytical_functional_unit_representation need not be specified for a particular Functional_unit_definition. There may be more than one Analytical_representation for an Functional_unit_definition.

4.2.338.2 ee_function

The ee_function specifies the name used to identify a Functional_unit_definition.

Constraints:

UR1: The ee_function shall be unique within a population of Functional_unit_definitions.

4.2.339 Functional_unit_network_definition

A Functional_unit_network_definition is a type of Functional_unit_definition (see 5.2.4.305). A Functional_unit_network_definition may be either one or both of an Electrical_network_definition (see 5.2.4.102) or a Thermal_network_definition (see 5.2.4.268).

The data associated with a Functional_unit_network_definition are the following:

— usage_view.

4.2.339.1 usage_view

The usage_view specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Functional_unit_network_definition.

Constraints:

WR1: The member of Functional_unit_usage_view specified as a usage_view by this member of functional_unit_network_definition shall be an Ee_product_definition of the same version of the product for which this member of Functional_unit_network_definition is an Ee_product_definition.

4.2.340 Functional_unit_network_node_definition

A Functional_unit_network_node_definition is a type of Managed_design_object (see 4.2.431). A Functional_unit_network_node_definition is the definition of a node in the Functional_unit_network_definition (see 5.2.4.339).

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The data associated with a Functional_unit_network_node_definition are the following:

— associated_functional_unit_definition;

— external_node_access;

— functional_unit_network_node_name.

4.2.340.1 associated_functional_unit_definition

The associated_functional_unit_definition specifies the Functional_unit_network_definition (see 5.2.4.339) that the Functional_unit_network_node_definition is helping to compose.

4.2.340.2 external_node_access

The external_node_access is an inverse relationship that specifies the Functional_unit_network_terminal_definition_node_assignment (see 5.2.4.271) that specifies the Functional_unit_network_node_definition as its composed_node. There shall be no more than one Functional_unit_network_terminal_definition_node_assignment for a Functional_unit_network_node_definition.

4.2.340.3 functional_unit_network_node_name

The functional_unit_network_node_name identifies the Functional_unit_network_node_definition in the context of the associated_functional_unit_definition.

Constraints:

UR1: The combination of the functional_unit_network_node_name and the associated_functional_unit_definition shall be unique within a population of Functional_unit_network_node_definitions.

WR1: A member of Functional_unit_network_node_definition shall be referenced by one or more members of Bus_element_relationship or by one or more members of Functional_unit_terminal_node_assignment.

WR2: No member of Bus_element_relationship shall reference a member of Functional_unit_network_node_definition if a member of Functional_unit_terminal_node_assignment is referencing the same member of Functional_unit_network_node_definition.

WR3: No member of Functional_unit_terminal_node_assignment shall reference a member of Functional_unit_network_node_definition if a member of Bus_element_relationship is referencing the same member of Functional_unit_network_node_definition.

WR4: Each member of Functional_unit_network_node_definition shall be referenced by no more than one member of Aggregate_connectivity_requirement.

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4.2.341 Functional_unit_network_terminal_definition_bus_assignment

Functional_unit_network_terminal_definition_bus_assignment is a type of Managed_design_object (see 4.2.431). A Functional_unit_network_terminal_definition_bus_assignment is the relationship between the structural definition of a bus and the terminal definition of a network to which the bus is assigned.

The data associated with a Functional_unit_network_terminal_definition_bus_assignment are the following:

— connected_bus;

— connected_terminal.

4.2.341.1 connected_bus

The connected_bus specifies the role of the Bus_structural_definition (see 4.2.65) for the Functional_unit_network_terminal_definition_bus_assignment.

4.2.341.2 connected_terminal

The connected_terminal specifies the role of the Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for the Functional_unit_network_terminal_definition_bus_assignment.

4.2.342 Functional_unit_network_terminal_definition_node_assignment

A Functional_unit_network_terminal_definition_node_assignment is a type of Managed_design_object (see 4.2.431). A Functional_unit_network_terminal_definition_node_assignment is the assignment relationship between a node definition of the functional unit network definition and a terminal definition of that network definition. This assignment provides visibility into the node definition from higher levels in the functional decomposition.

The data associated with a Functional_unit_network_terminal_definition_node_assignment are the following:

— composed_node;

— connected_terminal.

4.2.342.1 composed_node

The composed_node specifies the role of the Functional_unit_network_node_definition (see 4.2.340) for the Functional_unit_network_terminal_definition_node_assignment.

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4.2.342.2 connected_terminal

The connected_terminal specifies the role of the Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for the Functional_unit_network_terminal_definition_node_assignment.

4.2.343 Functional_unit_requirement_allocation

A Functional_unit_requirement_allocation is a type of Managed_design_object (see 4.2.431). A Functional_unit_requirement_allocation is the relationship between the Ee_requirement_occurrence (see 4.2.283) and the Functional_unit (see 5.2.4.313) that satisfies the Ee_requirement_occurrence.

The data associated with a Functional_unit_requirement_allocation are the following:

— functional_requirement;

— functional_unit_assignment.

4.2.343.1 functional_requirement

The functional_requirement specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Functional_unit_requirement_allocation.

4.2.343.2 functional_unit_assignment

The functional_unit_assignment specifies the Functional_unit (see 5.2.4.313) that satisfies the Ee_requirement_occurrence (see 4.2.283) for the Functional_unit_requirement_allocation.

4.2.344 Functional_unit_terminal

A Functional_unit_terminal is a type of Managed_design_object (see 4.2.431). A Functional_unit_terminal is an access mechanism for a Functional_unit (see 5.2.4.313).

The data associated with a Functional_unit_terminal are the following:

— accessed_functional_unit;

— bus_assignment;

— definition;

— node_assignment.

4.2.344.1 accessed_functional_unit

The accessed_functional_unit specifies the Functional_unit (see 5.2.4.313) whose functionality is accessed by the Functional_unit_terminal.

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4.2.344.2 bus_assignment

The bus_assignment is an inverse relationship that specifies the Functional_unit_terminal_bus_assignment (see 5.2.4.304) that specifies the Functional_unit_terminal as its connected_terminal. There shall be no more than one Functional_unit_terminal_bus_assignment for a Functional_unit_terminal.

4.2.344.3 definition

The definition specifies the role of the Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for the Functional_unit_terminal.

4.2.344.4 node_assignment

The node_assignment is an inverse relationship that specifies the Functional_unit_terminal_node_assignment (see 5.2.4.337) that specifies the Functional_unit_terminal as its connected_terminal. There shall be no more than one Functional_unit_terminal_node_assignment for a Functional_unit_terminal.

Constraints:

WR1: The definition of the Functional_unit this Functional_unit_terminal is associated with shall be either a Functional_unit_network_definition or a Functional_unit_usage_view.

WR2: Each Functional_unit_terminal shall not be assigned to a bus and to a node simultaneously.

4.2.345 Functional_unit_terminal_bus_assignment

A Functional_unit_terminal_bus_assignment is a type of Managed_design_object (see 4.2.431). A Functional_unit_terminal_bus_assignment is the relationship between the structural definition of a bus and a terminal that is assigned to the bus. The members of Functional_unit_terminal (see 5.2.4.267) that are assigned to the same bus by this application object are defined to be connected to each other.

NOTE There are cardinality constraints levied to ensure that the cardinality as resolved through all the references is identical.

The data associated with a Functional_unit_terminal_bus_assignment are the following:

— connected_bus;

— connected_terminal.

4.2.345.1 connected_bus

The connected_bus specifies the role of the Bus_structural_definition (see 4.2.65) for the Functional_unit_terminal_bus_assignment.

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4.2.345.2 connected_terminal

The connected_terminal specifies the role of the Functional_unit_terminal (see 5.2.4.267) for the Functional_unit_terminal_bus_assignment.

4.2.346 Functional_unit_terminal_node_assignment

A Functional_unit_terminal_node_assignment is a type of Managed_design_object (see 4.2.431). A Functional_unit_terminal_node_assignment is the assignment relationship between a Functional_unit_network_node_definition (see 4.2.340) and a Functional_unit_terminal (see 5.2.4.267).

The data associated with a Functional_unit_terminal_node_assignment are the following:

— composed_node;

— connected_terminal.

4.2.346.1 composed_node

The composed_node specifies the role of the Functional_unit_network_node_definition (see 4.2.340) for the Functional_unit_terminal_node_assignment.

4.2.346.2 connected_terminal

The connected_terminal specifies the role of the Functional_unit_terminal (see 5.2.4.267) for the Functional_unit_terminal_node_assignment.

4.2.347 Functional_unit_usage_view

A Functional_unit_usage_view is a type of Functional_unit_definition (see 5.2.4.305) that describes the usage of the Functional_unit (see 5.2.4.313) in a Functional_unit_definition.

The data associated with a Functional_unit_usage_view are the following:

— access_mechanism.

4.2.347.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Functional_unit_usage_view is dependent on the existence of the Functional_unit_usage_view_terminal_definition (see 5.2.4.306) that specifies the Functional_unit_usage_view as its associated_functional_unit_definition. There shall be one or more Functional_unit_usage_view_terminal_definition for a Functional_unit_usage_view.

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4.2.348 Functional_unit_usage_view_terminal_definition

A Functional_unit_usage_view_terminal_definition is a type of Managed_design_object (see 4.2.431). A Functional_unit_usage_view_terminal_definition may be a Scalar_terminal_definition (see 4.2.639). A Functional_unit_usage_view_terminal_definition is the definition of a Functional_unit_terminal (see 5.2.4.267).

The data associated with a Functional_unit_usage_view_terminal_definition are the following:

— associated_functional_unit_definition;

— bus_assignment;

— node_assignment;

— signal_name.

4.2.348.1 associated_functional_unit_definition

The associated_functional_unit_definition specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Functional_unit_usage_view_terminal_definition.

4.2.348.2 bus_assignment

The bus_assignment is an inverse relationship that specifies the Functional_unit_network_terminal_-definition_bus_assignment (see 4.2.341) that specifies the Functional_unit_terminal (see 5.2.4.267) as its connected_terminal. There shall be no more than one Functional_unit_network_terminal_definition_-bus_assignment for a Functional_unit_usage_view_terminal_definition.

4.2.348.3 node_assignment

The node_assignment is an inverse relationship that specifies the Functional_unit_network_terminal_-definition_node_assignment (see 5.2.4.271) that specifies the Functional_unit_terminal (see 5.2.4.267) as its connected_terminal. There shall be no more than one Functional_unit_network_terminal_definition_-node_assignment for a Functional_unit_usage_view_terminal_definition.

4.2.348.4 signal_name

The signal_name identifies the Functional_unit_usage_view_terminal_definition in the context of the Functional_unit_usage_view (see 4.2.347).

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Constraints:

UR1: The combination of the signal_name and the associated_functional_unit_definition shall be unique within a population of Functional_unit_usage_view_terminal_definitions.

WR1: Each Functional_unit_usage_view_terminal_definition shall not be assigned to a bus and to a node simultaneously.

4.2.349 Functional_usage_view_to_part_terminal_assignment

A Functional_usage_view_to_part_terminal_assignment is a type of Managed_design_object (see 4.2.431). A Functional_usage_view_to_part_terminal_assignment is the association between a Scalar_terminal_definition (see 4.2.639) and a Part_terminal (see 4.2.502). This is the fundamental mechanism for mapping between the functional view and the physical view of a design or library item.

The data associated with a Functional_usage_view_to_part_terminal_assignment are the following:

— functional_usage_view_terminal;

— physical_usage_view_terminal.

4.2.349.1 functional_usage_view_terminal

The functional_usage_view_terminal specifies the role of the Scalar_terminal_definition (see 4.2.639) for the Functional_usage_view_to_part_terminal_assignment.

4.2.349.2 physical_usage_view_terminal

The physical_usage_view_terminal specifies the role of the Part_terminal (see 4.2.502) for the Functional_usage_view_to_part_terminal_assignment.

Constraints:

UR1: The combination of functional_usage_view_terminal and physical_usage_view_terminal shall be unique within a population of Functional_usage_view_to_part_terminal_assignment.

WR1: The members of functional_usage_view_to_part_terminal_assignment that specify the same member of physical_unit_usage_view through the path physical_usage_view_terminal.associated_definition shall all specify the same member of functional_unit_definition through the path functional_usage_view_terminal.associated_functional_unit_definition.

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4.2.350 Functional_usage_view_to_printed_part_template_terminal_assignment

A Functional_usage_view_to_printed_part_template terminal_assignment is a type of Managed_design_-object (see 4.2.431). A Functional_usage_view_to_printed_part_template terminal_assignment is the association between a functional terminal definition and a terminal of a Printed_part_template (see 5.2.4.355).

EXAMPLE 1 It is permissible for one functional_usage_view_terminal to be assigned to more than one physical_usage_view_terminal, for example, VCC.

The data associated with a Functional_usage_view_to_printed_part_template_terminal_assignment are the following:

— functional_usage_view_terminal;

— physical_usage_view_terminal.

4.2.350.1 functional_usage_view_terminal

The functional_usage_view_terminal specifies the role of the Scalar_terminal_definition (see 4.2.639) for the Functional_usage_view_to_printed_part_template_terminal_assignment.

4.2.350.2 physical_usage_view_terminal

The physical_usage_view_terminal specifies the role of the Printed_part_template_terminal (see 4.2.586) for the Functional_usage_view_to_printed_part_template_terminal_assignment.

Constraints:

UR1: The combination of functional_usage_view_terminal and physical_usage_view_terminal shall be unique within a population of Functional_usage_view_to_printed_part_template_terminal_assignment.

WR1: The members of functional_usage_view_to_printed_part_template_terminal_assignment that specify the same member of physical_unit_usage_view through the path physical_usage_view_terminal.associated_-definition shall all specify the same member of functional_unit_definition through the path functional_-usage_view_terminal.associated_functional_unit_definition.

4.2.351 Gate_path_swap_specification

A Gate_path_swap_specification is a type of Change_design_object_management_relationship (see 4.2.74). This entity explicitly states that a path to a functional unit in a design shall be changed to a new path in the library of functional unit definitions.

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NOTE Normally the new path is based on the same root functional unit definition in the library, leading to a different path in the same technology, but there is no restriction in the standard that prohibits switching to a different functional unit definition in the library. If there is a new functional unit definition as root, other design changes will likely need to occur, but the mapping to identify those explicitly and relate them to this entity is not standardized, except through the use of the requirement_occurrence concept. Specifically, this entity needs to be used in conjunction with the component swap specification to swap between components if the path in the library is also changing.

EXAMPLE 1 An example is in the case where a change is being made from one microcircuit and its terminal, U1-A, to another microcircuit and terminal, U2-C.

The data associated with a Gate_path_swap_specification are the following:

— current_design_object;

— previous_design_object.

4.2.351.1 current_design_object

The current_design_object specifies the Design_functional_unit_allocation_to_reference_functional_-unit (see 5.2.4.400) that results from the swap in the Gate_path_swap_specification.

4.2.351.2 previous_design_object

The previous_design_object specifies the Design_functional_unit_allocation_to_reference_functional_-unit (see 5.2.4.400) from which the swap was made in the Gate_path_swap_specification.

4.2.352 Geometric_alignment

A Geometric_alignment is a type of Derived_shape_element (see 4.2.221) that is a linear or planar Shape_element (see 4.2.645) that is established to contain two or more aligned Shape_element. The Shape_element from which the Geometric_alignment is established are associated with the Geometric_-alignment by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_-relationships.

NOTE The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

EXAMPLE 1 A Geometric_alignment that is derived from the Centre_axis of a circular hole pattern and a Centre_axis of one of the holes of the pattern is a plane to which a Dimensional_location might be applied.

Constraints:

WR1: The Geometric_alignment shall be derived from two or more Shape_element.

IP1: In the case of a planar Derived_shape_element, at least one of the aligned Shape_element shall be a linear Shape_element.

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4.2.353 Geometric_intersection

A Geometric_intersection is a type of Derived_shape_element (see 4.2.221) that is the common intersection of two or more Shape_element (see 4.2.645). The Shape_element from which the Geometric_intersection is derived are associated with the Geometric_intersection by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_relationships.

NOTE The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

Constraints:

WR1: The Geometric_intersection shall be derived from two or more Shape_element.

IP1: The Shape_element from which the Geometric_intersection is derived shall intersect.

4.2.354 Geometric_tolerance

A Geometric_tolerance is a type of Managed_design_object (see 4.2.431). A Geometric_tolerance is one of a Geometric_tolerance_without_referenced_datum_system (see 4.2.358) or a Geometric_tolerance_with_referenced_datum_system (see 4.2.357). Additionally a Geometric_tolerance may be one of a Position_tolerance (see 4.2.558), a Profile_of_any_line_tolerance (see 5.2.4.41), or a Profile_of_any_surface_tolerance (see 4.2.596). A Geometric_tolerance may be Geometric_tolerance_with_applied_material_condition_property (see 4.2.356). Additionally, a Geometric_tolerance may be a Statistical_geometric_tolerance (see 5.2.4.46).

A Geometric_tolerance is a specification or partial specification of a design requirement on one or more of the form, location, or orientation characteristics of a Shape_element (see 4.2.645). This type of design requirement is specified in terms of a Tolerance_zone (see 4.2.732) within which the toleranced Shape_element must reside; or in the case of a Boundary_based_position_tolerance (see 4.2.59), a boundary that the toleranced Shape_element must not violate.

A Geometric_tolerance_with_referenced_datum_system participates in specifying a design requirement when the requirement is on one or more characteristics such as location of the toleranced Shape_element in relation to a Datum_system (see 5.2.4.316). In such cases, the Tolerance_zone is located and/or oriented, and thus the toleranced Shape_element is located and/or oriented, in relation to the Datum_system.

In some cases the design requirement is such that the boundary of the Tolerance_zone is on a per unit basis.

EXAMPLE 1 The design requirement on the flatness of a surface is such that the surface should not deviate by more than 0.5 mm in any 10 mm by 10 mm area. A Geometric_tolerance that defines a Tolerance_zone_definition_with_per_unit_size_specification (see 5.2.4.47) participates in specifying this type of requirement.

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In some cases a design requirement on the geometric characteristic or characteristics of a Shape_element is such that it is dependent upon the produced size of the Shape_element, or upon the produced size of the Shape_element from which it is derived. A Geometric_tolerance_with_applied_material_condition_property specifies this type of requirement.

The data associated with a Geometric_tolerance are the following:

— tolerance_zone_or_boundary_definition;

— toleranced_shape_element.

4.2.354.1 tolerance_zone_or_boundary_definition

The tolerance_zone_or_boundary_definition specifies either a Conical_tolerance_zone_boundary_diametrical_size_characteristic, a Positional_boundary_member_definition (see 5.2.4.324), a Profile_related_positional_boundary_definition (see 5.2.4.72), or a Tolerance_zone_definition (see 4.2.739) that defines the constraints placed on the Shape_element (see 4.2.645) specified as the toleranced_shape_element.

4.2.354.2 toleranced_shape_element

The toleranced_shape_element specifies either a Centre_Axis, Centre_plane (see 4.2.71), Centre_point (see 4.2.72), Physical_feature_or_part_template (see 4.2.527), or Tangent_plane (see 5.2.4.73) to which the Geometric_tolerance is applied.

Constraints:

WR1: The Geometric_tolerance shall either be a Geometric_tolerance_with_referenced_datum_system or a Geometric_tolerance_without_referenced_datum_system.

WR2: The Geometric_tolerance shall be specified by at most one Simultaneous_geometric_tolerance_requirement as one of the grouped_geometric_tolerances.

WR3: There shall be exactly one Ee_requirement_occurrence with the description of "Geometric Dimensioning and Tolerancing Reference" that specifies at least one Ee_specification as the requirement_specification.

IP1: There shall be exactly one Ee_requirement_occurrence with the description of "Geometric Dimensioning and Tolerancing Reference" that specifies at least one Ee_specification as the requirement_specification. The Ee_specification shall reference those standards by which the geometric dimensioning and tolerancing data is to be interpreted.

EXAMPLE 1 An Ee_requirement_occurrence with a description of "Geometric Dimensioning and Tolerancing Reference" specifies an Ee_specification as the requirement_specification. The Ee_specification may specify "Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run-out – Generalities, definitions, symbols, indications on drawings" as the document_name, 1995 as the year of the creation_date, "ISO" as the publisher, and an Ee_document_identifier as the base_identifier that has an assigned_value of "1101" and an identifier_name of "document number".

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4.2.355 Geometric_tolerance_qualifier

A Geometric_tolerance_qualifier is a type of Managed_design_object (see 4.2.431). A Geometric_tolerance_qualifier is either a Pre_defined_geometric_tolerance_qualifier (see 5.2.4.233) or a User_defined_geometric_tolerance_qualifier (see 5.2.4.387). A Geometric_tolerance_qualifier is a description that qualifies one or more Geometric_tolerance (see 5.2.4.386).

NOTE Qualifying notes are described in 5.3 of ISO/DIS 1101.

The data associated with a Geometric_tolerance_qualifier are the following:

— qualified_geometric_tolerances.

4.2.355.1 qualified_geometric_tolerances

The qualified_geometric_tolerances specifies the Geometric_tolerance (see 5.2.4.386) to which the Geometric_tolerance_qualifier applies. There shall be one or more Geometric_tolerance for a Geometric_tolerance_qualifier.

4.2.356 Geometric_tolerance_with_applied_material_condition_property

A Geometric_tolerance_with_applied_material_condition_property is a type of Geometric_tolerance (see 5.2.4.386) that specifies or partially specifies the design requirement on one or more geometric characteristics of the toleranced Shape_element (see 4.2.645) in which the restrictiveness of the requirement is dependent on the actual size of the produced Shape_element or the actual size of the produced Shape_element from which the toleranced Shape_element is derived. A Geometric_tolerance_with_applied_material_condition_property in which the applied_material_condition_property_name is "maximum_material_principle" participates in specifying a requirement that is less stringent as the produced Shape_element deviates from its maximum material condition towards its least material condition. In this case, the specified size of the Tolerance_zone_boundary (see 4.2.734) is the base size from which it is increased by the amount the produced Shape_element deviates from its maximum material condition towards its least material condition. A Geometric_tolerance_with_applied_material_condition_property in which the applied_material_condition_property_name is "least_material_requirement" participates in specifying a requirement that is less stringent as the produced Shape_element deviates from its least material condition towards its maximum material condition. In this case the specified size of the Tolerance_zone_boundary is the base size from which it is increased by the amount the produced Shape_element deviates from its least material condition towards its maximum material condition. A Geometric_tolerance_with_applied_material_condition_property may be a Boundary_based_position_tolerance (see 4.2.59).

The data associated with a Geometric_tolerance_with_applied_material_condition_property are the following:

— applied_material_condition_property_name.

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4.2.356.1 applied_material_condition_property_name

The applied_material_condition_property_name specifies the type of the applied material condition property, either "least_material_requirement" or "maximum_material_principle" for the Geometric_tolerance_with_applied_material_condition_property.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall either be a Centre_axis, Centre_plane, Centre_point, or Physical_feature_or_part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: If the Shape_element specified as the toleranced_shape_element is a Physical_feature_or_part_-template, the Geometric_tolerance_with_applied_material_condition_property shall also be a Boundary_based_position_tolerance.

4.2.357 Geometric_tolerance_with_referenced_datum_system

A Geometric_tolerance_with_referenced_datum_system is a type of Geometric_tolerance (see 5.2.4.386) that specifies or partially specifies the design requirement on one or more geometric characteristics, such as orientation, of the toleranced Shape_element (see 4.2.645) in relation to the Datum_system (see 5.2.4.316) defined by the Datum_system_defining_conditions (see 5.2.4.301) that is specified as the datum_system_definition. In such cases, the Tolerance_zone (see 4.2.732) is located and/or oriented; and thus the toleranced Shape_element is located and/or oriented; in relation to the Datum_system. A Geometric_tolerance_with_referenced_datum_system is one of an Angularity_tolerance (see 4.2.20), a Circular_runout_tolerance (see 4.2.78), a Concentricity_and_coaxiality_tolerance (see 5.2.4.152), a Parallelism_tolerance (see 5.2.4.123), a Perpendicularity_tolerance (see 5.2.4.397), a Profile_of_any_line_tolerance_with_referenced_datum_system (see 5.2.4.156), a Profile_of_any_surface_tolerance_with_referenced_datum_system (see 4.2.597), a Position_tolerance_with_referenced_datum_system (see 4.2.559), a Symmetry_tolerance (see 5.2.4.68), or a Total_runout_tolerance (see 5.2.4.398).

The data associated with a Geometric_tolerance_with_referenced_datum_system are the following:

— datum_system_definition.

4.2.357.1 datum_system_definition

The datum_system_definition specifies the Datum_system_defining_conditions (see 5.2.4.301) that define the Datum_system (see 5.2.4.316) that in relation to which the Geometric_tolerance_with_referenced_datum_system specifies or partially specifies design requirements.

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Constraints:

WR1: The Geometric_tolerance_with_referenced_datum_system shall be specified by at most one Separate_geometric_tolerance_requirement as one of the separated_geometric_tolerances.

4.2.358 Geometric_tolerance_without_referenced_datum_system

A Geometric_tolerance_without_referenced_datum_system is a type of Geometric_tolerance (see 5.2.4.386) that specifies or partially specifies the design requirement on one or more Datum_system (see 5.2.4.316) independent geometric characteristics such as flatness of the Shape_element (see 4.2.645) to which the Geometric_tolerance_without_referenced_datum_system is applied. A Geometric_tolerance_without_referenced_datum_system is one of a Circularity_tolerance (see 4.2.79), a Cylindricity_tolerance (see 5.2.4.126), a Flatness_tolerance (see 5.2.4.364), a Position_tolerance_without_referenced_datum_system (see 5.2.4.399), a Profile_of_any_line_tolerance_without_referenced_datum_system (see 5.2.4.401), a Profile_of_any_surface_tolerance_without_referenced_datum_system (see 5.2.4.35), or a Straightness_tolerance (see 4.2.676).

4.2.359 Geometrically_bounded_2d_wireframe

A Geometrically_bounded_2d_wireframe is a type of Feature_shape_definition (see 4.2.315). A Geometrically_bounded_2d_wireframe is a geometrically bounded wireframe with a dimensionality equal to 2.

NOTE The Geometrically_bounded_2d_wireframe, being a wireframe-based feature, does not support the representation of areas.

4.2.360 Geometrically_bounded_surface

A Geometrically_bounded_surface is a type of Bound_volume_shape (see 4.2.58). The Geometrically_bounded_surface is a surface that does not include topological information as to what edges are shared between surfaces. Only geometric information is supplied, which is useful only for presentation purposes. This entity should not be used to convey connectivity-related data unless independent connectivity reconstruction and verification is performed.

4.2.361 Guided_wave_bare_die_terminal

A Guided_wave_bare_die_terminal is a type of Minimally_defined_bare_die_terminal (see 4.2.447) used with guided waves in high frequency or fiber-optic applications.

4.2.362 Guided_wave_terminal

A Guided_wave_terminal is a type of Package_terminal (see 4.2.472) that is explicitly included for the purpose of providing access to the functionality of a Packaged_part (see 4.2.481) using guided waves.

EXAMPLE 1 Examples of Guided_wave_terminal include fiber-optic terminals and waveguide ports.

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Constraints:

WR1: A Guided_wave_terminal shall not be a Wire_terminal.

4.2.363 Inter_stratum_extent

An Inter_stratum_extent is a type of Managed_design_object (see 4.2.431). An Inter_stratum_extent is the extent of Stratum (see 4.2.677) specified for a design purpose. The extent includes the from_stratum and to_stratum.

The data associated with an Inter_stratum_extent are the following:

— from_stratum;

— to_stratum.

4.2.363.1 from_stratum

The from_stratum specifies the Stratum (see 4.2.677) at one end of the Inter_stratum_extent. This Stratum is the Stratum closer to the Design_layer_stratum (see 5.2.4.382) whose primary_design_layer_stratum attribute value is TRUE than is the to_stratum.

NOTE The from_stratum by convention is closest to the primary side of the assembly and furthest from the secondary side of the assembly.

4.2.363.2 to_stratum

The to_stratum specifies the Stratum (see 4.2.677) at one end of the Inter_stratum_extent. This Stratum is further from the Design_layer_stratum (see 5.2.4.382) whose primary_design_layer_stratum attribute value is TRUE than is the from_stratum.

NOTE The to_stratum by convention is furthest from the primary side of the assembly, and closest to the secondary side of the assembly.

Constraints:

WR1: The members of stratum specified by from_stratum and to_stratum shall be associated with the same definition of the same product.

NOTE When the from_stratum and to_stratum are the same Stratum the extent of the Inter_stratum_extent is that Stratum.

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4.2.364 Inter_stratum_feature

An Inter_stratum_feature is a type of Laminate_component (see 4.2.404) and a type of Physical_feature_or_part_template (see 4.2.527). An Inter_stratum_feature is one of a Cutout (see 5.2.4.31), a Cutout_edge_segment (see 5.2.4.27), a Dielectric_material_passage (see 5.2.4.371), an Interconnect_module_edge (see 5.2.4.413), an Interconnect_module_edge_segment (see 5.2.4.421), a Plated_inter_stratum_feature (see 5.2.4.422), or an Unsupported_passage (see 5.2.4.2). An Inter_stratum_feature spans one or more Stratum (see 4.2.677).

NOTE 1 An Inter_stratum_feature may be realized by removal of material by drilling, routing, punching, chemically etching, laser burning, or otherwise penetrating one or more sequential Stratum; by the addition of material; or by combining both removal and addition of material in the fabrication process.

NOTE 2 Keep out or keep in regions can be specified by populating Interconnect_module_constraint_region and its optional set of Interconnect_module_desgin_object_select. The Interconnect_module_design_object_select can select an Inter_startum_feature as the design feature of interest.

The data associated with an Inter_stratum_feature are the following:

— feature_of_size;

— usage_definition.

NOTE Minimum and maximum material conditions are related to Inter_stratum_feature by its attribute usage_definition. The maximum and minimum material conditions established keep-out areas. Since these maximum and minimum conditions reflect a fabrication process, the designer does not have this area to locate other features. A situation such as tight spacing of conductors on a PWB must take into account the maximum and minimum material condition or the design wil not be optimally realized through the fabrication process.

4.2.364.1 feature_of_size

The feature_of_size specifies whether or not the Inter_stratum_feature interfaces with a feature of another product in an assembly context. A value of TRUE specifies that it interfaces. A value of FALSE specifies that it does not interface.

NOTE Certain tolerance information depends on knowledge of a particular feature interfacing with features of a mating product. The maximum material conditions of the Inter_stratum_feature and of the feature of the mating product are taken into consideration for calculating the fit at assembly.

4.2.364.2 usage_definition

The usage_definition specifies the role of the Inter_stratum_feature_template (see 5.2.4.76) for the Inter_stratum_feature.

4.2.365 Inter_stratum_feature_edge_segment_template

An Inter_stratum_feature_edge_segment_template is a type of Inter_stratum_feature_template (see 5.2.4.76).

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The data associated with an Inter_stratum_feature_edge_segment_template are the following:

— composed_edge;

— end_vertex;

— start_vertex.

4.2.365.1 composed_edge

The composed_edge specifies the role of the Inter_stratum_feature_edge_template (see 5.2.4.8) the Inter_stratum_feature_edge_segment_template is helping to compose.

4.2.365.2 end_vertex

The end_vertex specifies one role of the Edge_segment_vertex (see 5.2.4.70) for the Inter_stratum_feature_edge_segment_template.

4.2.365.3 start_vertex

The start_vertex specifies one role of the Edge_segment_vertex (see 5.2.4.70) for the Inter_stratum_feature_edge_segment_template.

Constraints:

WR1: The end_vertex shall not be the start_vertex.

4.2.366 Inter_stratum_feature_edge_template

An Inter_stratum_feature_edge_template is a type of Inter_stratum_feature_template (see 5.2.4.76).

The data associated with an Inter_stratum_feature_edge_template are the following:

— edges.

4.2.366.1 edges

The edges is an inverse relationship that specifies that the existence of the Inter_stratum_feature_edge_template is dependent on the existence of the Inter_stratum_feature_edge_segment_template (see 5.2.4.6) that specifies the Inter_stratum_feature_edge_template as its composed_edge. There shall be two or more Inter_stratum_feature_edge_segment_template for an Inter_stratum_feature_edge_template.

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4.2.367 Inter_stratum_feature_template

An Inter_stratum_feature_template is a type of Part_template (see 4.2.498). An Inter_stratum_feature_-template may be one of a Component_termination_passage_template (see 5.2.4.57), an Unsupported_-passage_template (see 4.2.756), or a Via_template (see 5.2.4.19). An Inter_stratum_feature_template is a definitional construct that defines the cross-section shape of layered constructs.

The data associated with an Inter_stratum_feature_template are the following:

— of_passage_technology.

4.2.367.1 of_passage_technology

The of_passage_technology specifies the role of the Passage_technology (see 4.2.509) for the Inter_-stratum_feature_template. The op_passage_technology specifies the material and layered properties for the Inter_stratum_feature_template.

4.2.368 Inter_stratum_join_implementation

An Inter_stratum_join_implementation is a type of Managed_design_object (see 4.2.431). An Inter_stratum_join_implementation is one of a Physical_network_supporting_inter_stratum_feature (see 5.2.4.30) or a Physical_network_supporting_stratum_feature_conductive_join (see 5.2.4.32). An Inter_stratum_-join_implementation is a physical feature helping to implement a Physical_network (see 5.2.4.17). An Inter_stratum_join_implementation is not intended to be implemented alone. It is one of several Application Objects that together form the physical network implementation model.

NOTE 1 The types of Inter_stratum_join_implementation correspond to two physical implementation mechanisms.

NOTE 2 The first mechanism consists of creating a passage or edge in the material and then adding conductive material to the passage or edge wall and features on the to_stratum and from_stratum of the Inter_stratum_extent (see 5.2.4.83). This mechanism results in a connection between the required features implemented with the passage or edge wall.

NOTE 3 The second mechanism does not result in a conducting passage, but relies on a bond (achieved either by direct deposition or some other means) between the features related to the specified layer_connection_points. The second mechanism usually relies on a passage in only the dielectric material separating the bonded materials. A cross-sectional view of the pcb may show a vertical displacement of strata in the area of this object, due to the fact that the dielectric Stratum (see 4.2.677) is much thicker than the conductive Stratum. The shape of the vertical displacement is not a part of the definition of the Inter_stratum_join_implementation when the second mechanism is used.

The data associated with an Inter_stratum_join_implementation are the following:

— topological_requirement.

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4.2.368.1 topological_requirement

The topological_requirement specifies the role of the Inter_stratum_join_relationship (see 5.2.4.33) for the Inter_stratum_join_implementation.

NOTE The following is a description of a realization of an Inter_stratum_join_implementation appropriate for some technologies. Features that implement inter layer connection are realized by forming passages in the sequence of stratum that define the extent of the passage. The passage has a nominally uniform cross-section and has a direction normal to the surface specified as the from_stratum. If that surface is not planar, then the surface coordinates of the layer connection points vary layer to layer to account for the finite thickness of the stratum comprising the Stratum.

4.2.369 Inter_stratum_join_relationship

An Inter_stratum_join_relationship is a type of Join_relationship (see 5.2.4.34), in which the elements to be joined, Layer_connection_point (see 5.2.4.420), shall be on different Design_layer_stratum (see 5.2.4.382). An Inter_stratum_join_relationship is a requirement for a Inter_stratum_join_implementation (see 5.2.4.22).

NOTE In order for a design to be complete the Inter_stratum_join_implementation that specifies Inter_stratum_join_relationship in the role of topological_requirement must be populated.

Constraints:

WR1: No member of Design_layer_stratum shall be the resident_stratum for more than one member of Layer_connection_point that is joined by the same member of the Inter_stratum_join_relationship.

4.2.370 Interconnect_component_interface_terminal

An Interconnect_component_interface_terminal is a type of Component_interface_terminal (see 4.2.97) that is some aspect of a generic Assembly_component (see 4.2.27) participate in a connection for a Pca (see 4.2.510). The Interconnect_component_interface_terminal is defined in-situ. There is no Part_feature (see 4.2.494) associated with it.

EXAMPLE 1 An example of an Interconnect_component_interface_terminal is a mechanical conductive fastener that attaches a flexible wire lead lug to the pcb. Current flows through the fastener because it is part of the conduction path for a signal.

EXAMPLE 2 A plain wire is considered to be an interconnect component as well. This Interconnect_component_interface_terminal is defined in-situ. There is no Part_feature (see 4.2.494) associated with it. This is the opposite end of the wire from that defined for the same wire in Interconnect_component_join_terminal (see 4.2.371).

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The data associated with an Interconnect_component_interface_terminal are the following:

— connection;

— name.

4.2.370.1 connection

The connection specifies the role of the Connection_zone (see 4.2.147) for the Interconnect_component_interface_terminal.

4.2.370.2 name

The name specifies the string for the human-interpretable identifier for this Interconnect_component_interface_terminal.

Constraints:

UR1: The combination of the name and the inherited associated_component shall be unique within a population of Interconnect_component_interface_terminal.

WR1: The shapes that describe the connection_zone specified by connections shall reside on one or more surfaces of the assembly_component in the role of associated_component specified by the supertype component_feature.

WR2: An Interconnect_component_interface_terminal shall participate in only one Assembly_joint (see 4.2.32).

4.2.371 Interconnect_component_join_terminal

An Interconnect_component_join_terminal is a type of Component_terminal (see 4.2.105) that is some aspect of a generic Assembly_component (see 4.2.27) participating in connectivity for a Pca (see 4.2.510). This Interconnect_component_join_terminal is defined in-situ.

EXAMPLE 1 An example of an Interconnect_component_join_terminal is a mechanical conductive fastener that attaches a flexible wire lead lug to the pcb. Current flows through the fastener because it is part of the conduction path for a signal.

EXAMPLE 2 A plain wire is considered to be a mechanical component as well. There is no Part_feature (see 4.2.494) associated with it. This is the opposite end of the wire from that defined for the same wire in Interconnect_component_interface_terminal (see 4.2.370).

The data associated with an Interconnect_component_join_terminal are the following:

— connection;

— name.

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4.2.371.1 connection

The connection specifies the role of the Connection_zone (see 4.2.147) for the Interconnect_component_join_terminal.

4.2.371.2 name

The name specifies the string for the human-interpretable identifier for this Interconnect_component_join_terminal.

Constraints:

UR1: The combination of the name and the inherited associated_component shall be unique within a population of Interconnect_component_join_terminal.

WR1: The shapes that describe the connection_zone specified by connections shall reside on one or more surfaces of the assembly_component in the role of associated_component specified by the supertype Component_feature of this terminal.

WR2: Interconnect_component_join_terminal shall participate in no more than one Assembly_joint.

4.2.372 Interconnect_module

An Interconnect_module is a type of Physical_unit_design_view (see 4.2.535). An Interconnect_module may be a Pcb (see 5.2.4.38). An Interconnect_module is a design view of a product. An Interconnect_module may be an aggregation of Stratum (see 4.2.677). An Interconnect_module may be an aggregation of Interconnect_module_component (see 4.2.373) An Interconnect_module features are defined by Stratum_feature (see 4.2.683), within the bounds established by Inter_stratum_feature (see 4.2.364).

NOTE Not all products defined by this design view are classified in general as interconnect substrates.

EXAMPLE 1 A package may be defined by the design owners using the Interconnect_module design view.

EXAMPLE 2 A ribbon cable, minus the connectors, may be defined by the design owners using the Interconnect_module design view. Complex 3d arrangements of the ribbon may be supported.

The data associated with an Interconnect_module are the following:

— assembly_design_requirement.

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4.2.372.1 assembly_design_requirement

The assembly_design_requirement specifies the Assembly_module (see 4.2.34) for the Interconnect_-module as a specified source of requirements not otherwise explicitly allocated to the Interconnect_-module. This requirement shall be interpreted as establishing a direct relationship to the assembly or assemblies that define data that may be used as requirements for the Interconnect_module. The assembly_design_requirement need not be specified for a particular Interconnect_module. There may be more than one Assembly_module for a Interconnect_module.

NOTE This relationship is provided so that design requirements may be traced to the original source even though an Interconnect_module may be designed into many subsequent assembly designs.

NOTE Explicit data requirements may be contained in one or more assembly design views. These multiple requirements can be specified by the the Componenet_external_reference and Component_feature_external_reference application objects. Component features which are contained in one design view may be associated to layout features that are contained in another design view. Component_external_reference and Component_feature_external_reference maintain this association while also maintaining the completeness of the design view.

Constraints:

WR1: If the attribute name specified by Ee_product_category (see 4.2.275) that is in the role of product_classification specified by Ee_product (see 4.2.274) that is in the role of versioned_item specified by Ee_product_version (see 4.2.282) that is in the role of version specified by the supertype Ee_product_definition is "Interconnect module", and if the sub category of the Ee_product_category is "land pattern", then the purpose for inclusion is to provide land pattern source data for a particular technology of interconnect substrate, that may be manufacturer specific or industry standard. The attribute standard_product_indicator specified by the same member of Ee_product shall be true for industry standard pattern and material designation. The material designations, arrangement, etc., are included as part of this definition since this application object is a design view. The instantiation of the land pattern into the design is accomplished using the Component_make_from_relationship (see 4.2.98) to specify each component of the land pattern as it is reused in the design.

WR2: A Laminate_component shall be in the role of a component for the Assembly_composition_-relationship that references an Interconnect_module in the role of assembly.

NOTE The purpose of this usage of Interconnect_module is to allow sufficient information to be exchanged to explicitly state the material and processing dependencies of applications of land patterns.

EXAMPLE 1 Figure 5.2.4.43 illustrates two categories of complex land patterns. For a specific technology implementation in an Interconnect_module, all parameters would be assigned specific values, in addition to the explicit geometry and material descriptions otherwise provided.

EXAMPLE 2 Figure 5.2.4.50 illustrates two categories of simple land patterns. For a specific technology implementation in an Interconnect_module, all parameters would be assigned specific values, in addition to the explicit geometry and material descriptions otherwise provided.

WR3: Interconnect_module.usage_view (this is an inherited attribute from Physical_unit_design_view) shall be either an Interconnect_module_usage_view or a Package.

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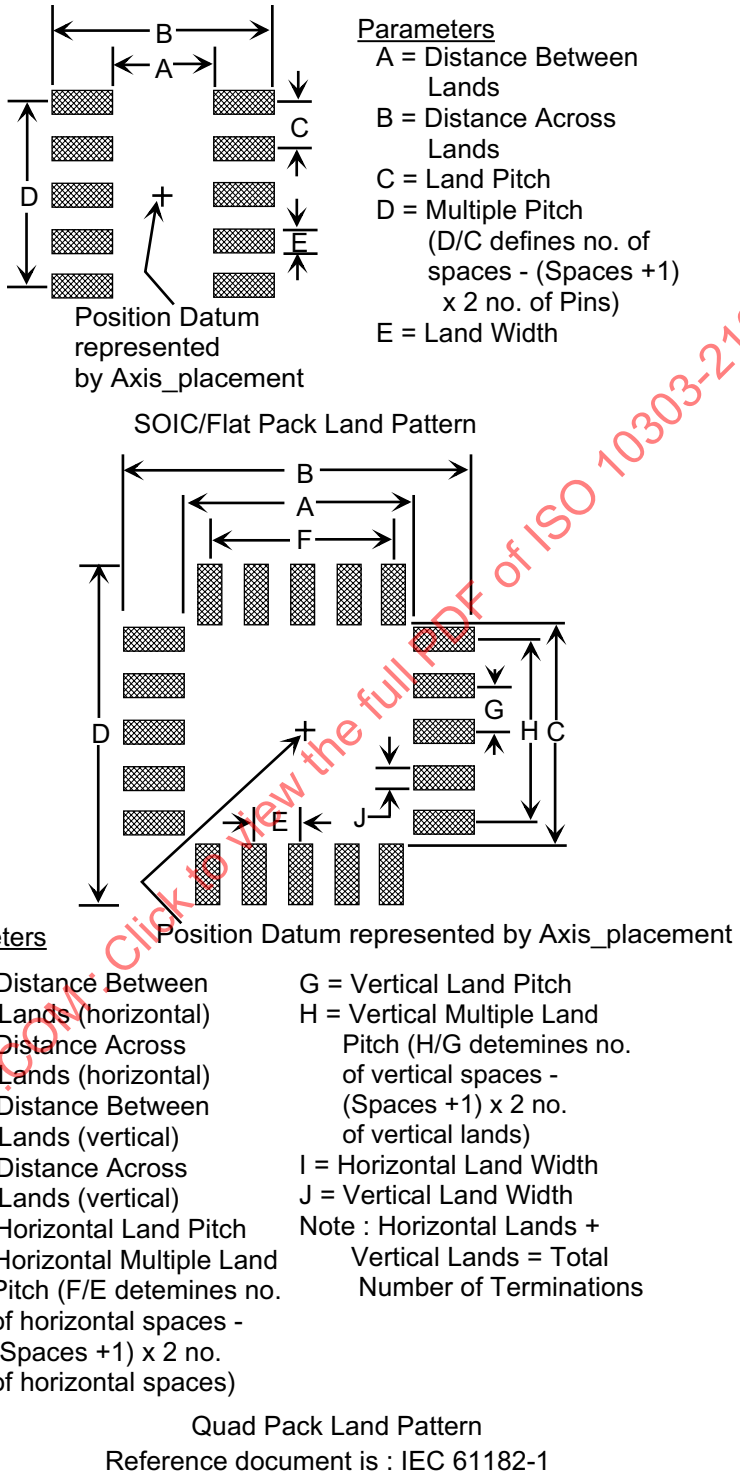

Figure 47 – Complex technology specific land pattern definition

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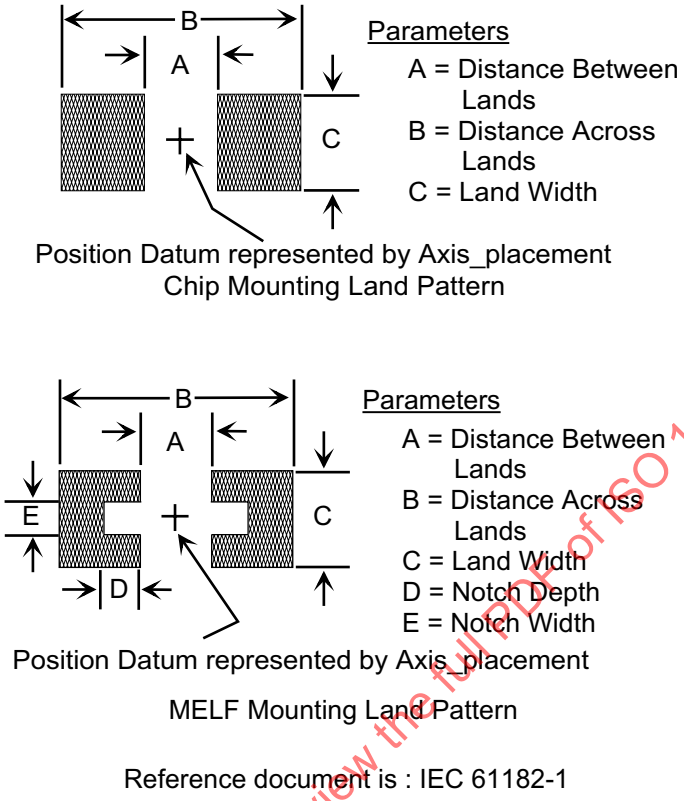

Figure 48 – Simple technology specific land pattern definition

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4.2.373 Interconnect_module_component

An Interconnect_module_component is a type of Assembly_component (see 4.2.27). An Interconnect_-module_component is an instance of an Interconnect_module_usage_view.

NOTE The Interconnect_module_component can be, for example, a circuit board in an assembly. Alternatively, it could be the substrate for a multi-chip module. This entity is included specifically so that the assembly design definition can be queried directly to determine which component in the assembly is the substrate. The Interconnect_module_component is likely the target of connectivity requirement information as allocated to various components. An Interconnect_module_component does not include all the internal details of the design of the Interconnect_module (see 4.2.372).

The data associated with an Interconnect_module_component are the following:

— access_mechanisms;

— usage_definition.

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4.2.373.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Interconnect_module_component is dependent on the existence of the Interconnect_module_component_terminal (see 4.2.376) that specify the Interconnect_module_component as their associated_component. There shall be two or more Interconnect_module_component_terminals for an Interconnect_module_component.

4.2.373.2 usage_definition

The usage_definition specifies the role of the Interconnect_module_usage_view (see 4.2.389) for the Interconnect_module_component.

NOTE The usage_view specifies the definitions of the terminals and other interface elements of the Interconnect_module (see 4.2.372).

Constraints:

WR1: An Interconnect_module_component shall not be mounted onto itself.

4.2.374 Interconnect_module_component_stratum_based_terminal

An Interconnect_module_component_stratum_based_terminal is a type of Interconnect_module_component_terminal (see 4.2.376) included to support the case where explicit Interconnect_module_component_terminals are being connected by an Interconnect_module_product_assembly_view_fabrication_joint (see 5.2.4.78) as part of a sequential laminate assembly view for design or analysis purposes.

NOTE A sequential laminate assembly description may be necessary to support embedded discrete components.

The data associated with an Interconnect_module_component_stratum_based_terminal are the following:

— definition.

4.2.374.1 definition

The definition specifies the role of the Interconnect_module_stratum_based_terminal (see 5.2.4.79) for the Interconnect_module_component_stratum_based_terminal.

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4.2.375 Interconnect_module_component_surface_feature

An Interconnect_module_component_surface_feature is a type of Component_feature (see 4.2.90). An Interconnect_module_component_surface_feature is a surface or a segment of the edge of the Interconnect_module_component (see 4.2.373) identified for assembly purposes. The definition attribute inherited from Component_feature (see 4.2.90) shall specify a type of Interconnect_module_surface_feature (see 5.2.4.105). The associated_component attribute inherited from Component_feature shall specify a member of Interconnect_module_component (see 4.2.373). An Interconnect_module_component_surface_feature may also be an Interconnect_module_component_terminal (see 4.2.376), but shall not be any other type of Component_feature.

NOTE The entire primary or secondary surface of the Interconnect_module_component may be considered to be a feature in this usage.

4.2.376 Interconnect_module_component_terminal

An Interconnect_module_component_terminal is a type of Component_terminal (see 4.2.105). An Interconnect_module_component_terminal may be an Interconnect_module_component_stratum_based_terminal (see 5.2.4.60). A member of Interconnect_module_component_terminal may be referenced by a member of Assembly_joint to describe the partial or complete implementation of a connection defined as a requirement by a member of Physical_connectivity_definition.

EXAMPLE 1 Figure 5.2.4.106 illustrates the relationship between an Interconnect_module_component_terminal and its mating feature in an assembly.

The data associated with an Interconnect_module_component_terminal are the following:

— associated_component;

— definition.

4.2.376.1 associated_component

The associated_component specifies the role of the Interconnect_module_component (see 4.2.373) for the Interconnect_module_component_terminal.

4.2.376.2 definition

The definition specifies the role of the Interconnect_module_terminal (see 5.2.4.211) for the Interconnect_module_component_terminal.

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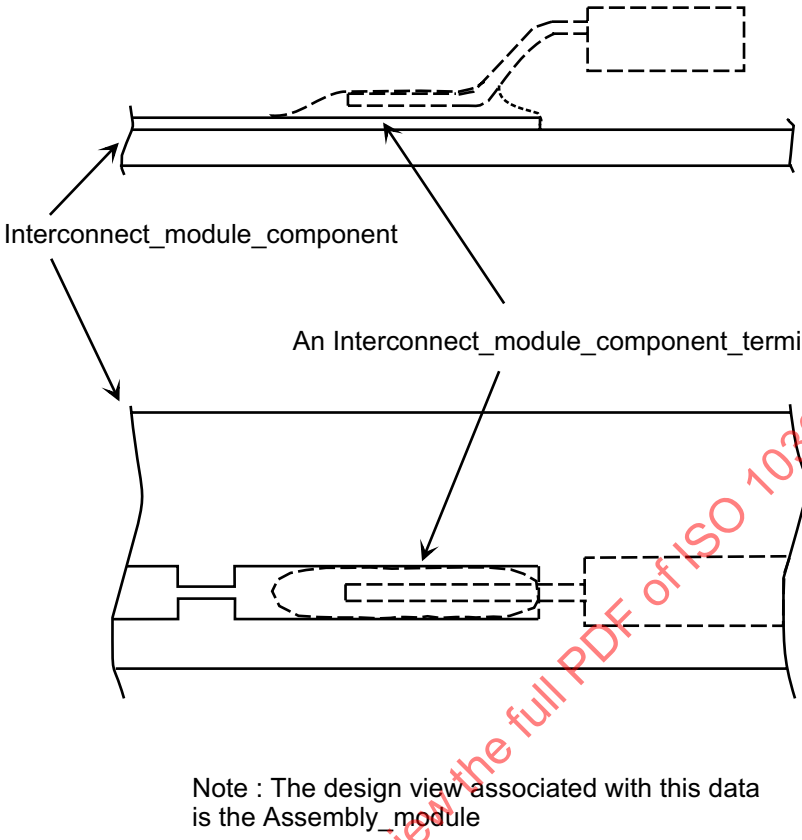

Figure 49 – Interconnect_module_component_terminal in an assembly

4.2.377 Interconnect_module_constraint_region

An Interconnect_module_constraint_region is a type of Managed_design_object (see 4.2.431). An Interconnect_module_constraint_region is a region within an Interconnect_module (see 4.2.372) in which a placement constraint on some category of design object is to be met by the design. An Interconnect_module_constraint_region may overlap other Interconnect_module_constraint_regions. The origin of the shape representing an Interconnect_module_constraint_region shall be congruent with the origin of the Interconnect_module in the role of scope. The congruency requirement shall be interpreted as a requirement for a unity transformation from the shape of the Interconnect_module_constraint_region into the placement in the Interconnect_module shape.

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The data associated with an Interconnect_module_constraint_region are the following:

— area;

— associated_stratum_extent;

— constrained_design_object_category;

— design_specific_purpose;

— keepout;

— non_conformant_interconnect_module_design_object;

— requirement;

— scope.

4.2.377.1 area

The area specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Interconnect_module_-constraint_region.

4.2.377.2 associated_stratum_extent

The associated_stratum_extent specifies the Inter_stratum_extent (see 5.2.4.83) as the extent of Stratum (see 4.2.677) for the Interconnect_module_constraint_region. There shall be one or more Inter_stratum_-extent for an Interconnect_module_constraint_region. The Inter_stratum_extent shall all be for the same scope.

4.2.377.3 constrained_design_object_category

The constrained_design_object_category specifies either an interconnect_module_cutout, an interconnect_module_fill_area, an interconnect_module_inter_stratum_feature, an interconnect_module_stratum_-feature, or an interconnect_module_via as a category for the Interconnect_module_constraint_region. There may be more than one interconnect_module_cutout, interconnect_module_fill_area, interconnect_module_inter_stratum_feature, or interconnect_module_via for an Interconnect_module_constraint_-region. The names shall be interpreted as the identification of Application Object categories to be constrained.

4.2.377.4 design_specific_purpose

The design_specific_purpose identifies the purpose the enterprise defined for the Interconnect_module_-constraint_region.

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4.2.377.5 keepout

The keepout specifies if the meaning of the Interconnect_module_constraint_region is to describe that items shall be in the interior of the area or shall be on the exterior of the area. The value of TRUE states that objects in the constrained_design_object_category are not to be within the area. The value of FALSE states that objects in the constrained_design_object_category are to be only within the area.

4.2.377.6 non_conformant_interconnect_module_design_object

The non_conformant_interconnect_module_design_object specifies either a Component_termination_-passage (see 5.2.4.227), a Conductive_filled_area (see 5.2.4.365), a Conductor (see 5.2.4.162), a Cutout (see 5.2.4.31), an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Land (see 4.2.407), a Non_functional_land (see 5.2.4.274), a Stratum_feature (see 4.2.683), or a Via (see 4.2.761) for the Interconnect_module_constraint_region. There may be more than one Component_termination_passage, Conductive_filled_area, Conductor, Cutout, Inter_stratum_feature, Laminate_component, Land, Non_functional_land, Stratum_feature (see 4.2.683), or Via for an Interconnect_module_-constraint_region.

4.2.377.7 requirement

The requirement specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Interconnect_-module_constraint_region.

4.2.377.8 scope

The scope specifies the Interconnect_module (see 4.2.372) for the Interconnect_module_constraint_-region. There shall be one or more Interconnect_module for a Interconnect_module_constraint_region.

Constraints:

WR1: Each member of scope shall specify a unique Ee_product_version.

WR2: Each member of scope shall specify the same Ee_product.

4.2.378 Interconnect_module_edge

An Interconnect_module_edge is a type of Inter_stratum_feature (see 4.2.364). When this information is represented by a planar shape, the interpretation is to be that the planar shape represents a projection of the maximum extent of the Interconnect_module_edge onto the planar shape. The Interconnect_-module_edge forms an outer physical boundary of the interconnect substrate.

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Constraints:

WR1: Each member of Interconnect_module_edge shall only be an external feature of the Interconnect_module.

WR2: Any geometry representing a member of Interconnect_module_edge shall be interpreted by a receiving system as a closed curve or a closed volume, depending on the dimensionality of the geometry.

4.2.379 Interconnect_module_edge_segment

An Interconnect_module_edge_segment is a type of Inter_stratum_feature (see 4.2.364). The Interconnect_module_edge_segment is an entity with a uniquely specified shape that makes up part of the edge of an interconnect module.

EXAMPLE 1 Usually each side of a four-sided board is an Interconnect_module_edge_segment, or if a board is a round board, one of the Interconnect_module_edge_segment's may be a notch for orientation purposes. The set of Interconnect_module_edge_segment's together make up the total edge.

The data associated with an Interconnect_module_edge_segment are the following:

— composed_edge;

— end_vertex;

— start_vertex.

4.2.379.1 composed_edge

The composed_edge specifies the role of the Interconnect_module_edge (see 5.2.4.413) for the Interconnect_module_edge_segment.

4.2.379.2 end_vertex

The end_vertex specifies one role of an Edge_segment_vertex for an Interconnect_module_edge_segment.

4.2.379.3 start_vertex

The start_vertex specifies one role of an Edge_segment_vertex for an Interconnect_module_edge_segment.

Constraints:

WR1: The end_vertex shall not be the start_vertex.

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4.2.380 Interconnect_module_edge_segment_surface

An Interconnect_module_edge_segment_surface is a type of Interconnect_module_surface_feature (see 5.2.4.105). An Interconnect_module_edge_segment_surface identifies a segment of the edge surface of the Interconnect_module (see 4.2.372) for fabrication and assembly purposes.

NOTE This data is usage view contextual data.

If a design view is provided and this member of Interconnect_module_edge_segment_surface is specified by a member of Stratum_concept_to_physical_usage_view_assignment (see 5.2.4.136) in the role of defined_part_feature, a member of Interconnect_module_edge_segment (see 5.2.4.421) or a member of Plated_interconnect_module_edge_segment (see 5.2.4.144) shall be the only possibilities permitted to be specified for the role of assigned_design_object for that member of Stratum_concept_to_physical_-usage_view_assignment.

The data associated with an Interconnect_module_edge_segment_surface are the following:

— composed_surface;

— end_vertex;

— start_vertex.

4.2.380.1 composed_surface

The composed_surface specifies an Interconnect_module_edge_surface for an Interconnect_module_-edge_segment (see 5.2.4.421).

4.2.380.2 end_vertex

The end_vertex specifies one role of an Edge_segment_surface for an Interconnect_module_edge_seg-ment_surface.

4.2.380.3 start_vertex

The end_vertex specifies one role of an Edge_segment_surface for an Interconnect_module_edge_seg-ment_surface.

Constraints:

WR1: The end_vertex shall not be the start_vertex.

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4.2.381 Interconnect_module_edge_surface

An Interconnect_module_edge_surface is a type of Interconnect_module_surface_feature (see 5.2.4.105). An Interconnect_module_edge_surface identifies the edge surface of the Interconnect_module (see 4.2.372) for fabrication and assembly purposes.

4.2.382 Interconnect_module_primary_surface

An Interconnect_module_primary_surface is a type of Interconnect_module_surface_feature (see 5.2.4.105). An Interconnect_module_primary_surface identifies the primary surface of the Interconnect_module (see 4.2.372) for fabrication and assembly purposes. A member of Stratum_concept_to_physical_usage_view_assignment (see 5.2.4.136) shall be populated in order to associate this object to the primary Stratum (see 4.2.677) if a design view of the substrate is included in the data. An Interconnect_module_primary_surface is an approximation of the real primary surface.

NOTE It is not usually the case that the physical material visible on the surface of the substrate or pcb is the same material as that of the primary Stratum. The level of information provided by this object is usually sufficient for assembly purposes, but will be in error by the thickness of the Stratum above the primary Stratum. If more accuracy is desired, the population of Adjacent_stratum_surface_definition (see 4.2.2) may be queried to determine the Stratum that is specified by only the precedent_surface attribute. That Stratum will be the material of at least part of the surface of the substrate. Full three-dimensional representation capability and location of individual Interconnect_module_component_terminal (see 4.2.376) associated by Assembly_joint (see 4.2.32) to the component feature being assembled to the substrate is required to represent exactly the mating conditions.

4.2.383 Interconnect_module_product_assembly_view_fabrication_joint

An Interconnect_module_product_assembly_view_fabrication_joint is a type of Managed_design_object (see 4.2.431). It specifies the bond among Interconnect_module_component_stratum_based_terminal (see 5.2.4.60) which is created during an assembly process. The detailed process description of how to create the bond is not included.

NOTE This Application Object is intended to support a limited view of an interconnect product where the vertical or sequential arrangement of intermediate assemblies is of interest, and the detailed information available in Stratum (see 4.2.677) is not of interest.

The data associated with an Interconnect_module_product_assembly_view_fabrication_joint are the following:

— joined_terminal.

4.2.383.1 joined_terminal

A joined_terminal specifies one or more Interconnect_module_component_stratum_based_terminal (see 5.2.4.60) for the Interconnect_module_product_assembly_view_fabrication_joint.

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4.2.384 Interconnect_module_secondary_surface

An Interconnect_module_secondary_surface is a type of Interconnect_module_surface_feature (see 5.2.4.105). An Interconnect_module_secondary_surface identifies the secondary surface of the Interconnect_module (see 4.2.372) for fabrication and assembly purposes. If a design view is populated, and correlation to a Stratum (see 4.2.677) is provided, the Stratum associated with this member of Interconnect_module_primary_surface (see 5.2.4.146) shall be the last Stratum in the design.

NOTE The Stratum_concept_to_physical_usage_view_assignment (see 5.2.4.136), Adjacent_stratum_surface_definition (see 4.2.2), and Stratum_surface (see 4.2.699) provide supporting data needed to resolve the position of the Stratum in the design. Because the secondary surface is derived structurally from the primary Stratum, there is no approximation made in the description.

4.2.385 Interconnect_module_stratum_assembly_relationship

An Interconnect_module_stratum_assembly_relationship is a type of Managed_design_object (see 4.2.431). An Interconnect_module_stratum_assembly_relationship is the composition association between an Interconnect_module (see 4.2.372) and the Stratum (see 4.2.677) helping to compose it.

The data associated with an Interconnect_module_stratum_assembly_relationship are the following:

— assembly;

— component;

— reference_designation;

— stratum_3d_position;

— stratum_planar_position.

4.2.385.1 assembly

The assembly specifies the role of the Interconnect_module (see 4.2.372) for the Interconnect_module_stratum_assembly_relationship. There shall be one or more Interconnect_module for the Interconnect_module_stratum_assembly_relationship.

4.2.385.2 component

The component specifies the role of the Stratum (see 4.2.677) for the Interconnect_module_stratum_assembly_relationship.

4.2.385.3 reference_designation

The reference_designation specifies the string for the human-interpretable identifier for the Interconnect_module_stratum_assembly_relationship.

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4.2.385.4 stratum_3d_position

The stratum_3d_position is an inverse relationship that specifies the Stratum_interconnect_module_-3d_position (see 5.2.4.170) that specifies the Interconnect_module_stratum_assembly_relationship as its stratum_component. There shall be no more than one Stratum_interconnect_module_3d_position for an Interconnect_module_stratum_assembly_relationship.

4.2.385.5 stratum_planar_position

The stratum_planar_position is an inverse relationship that specifies the Stratum_interconnect_module_-planar_position (see 5.2.4.178) that specifies the Interconnect_module_stratum_assembly_relationship as its stratum_component. There shall be no more than one Stratum_interconnect_module_planar_-position for an Interconnect_module_stratum_assembly_relationship.

Constraints:

UR1: The combination of the assembly and the reference_designation shall be unique within a population of Interconnect_module_stratum_assembly_relationship.

WR1: The members of assembly shall all be for the same product.

WR2: Each member of assembly shall be for a separate product version.

4.2.386 Interconnect_module_stratum_based_terminal

An Interconnect_module_stratum_based_terminal is a type of Interconnect_module_terminal (see 5.2.4.211).

NOTE The Interconnect_module_stratum_based_terminal is an artifact that is defined in the design organization but generally will be assigned to only those lands or non_functional_lands that are intended to be penetrated with plated passages in the final product. This is only used in the case where sequential stackups are defined, and is derived from knowledge of the substrate design and intended lamination sequence.

Constraints:

WR1: An Interconnect_module_stratum_based_terminal shall not be an assignment of an Inter_stratum_feature by a member of Stratum_concept_to_physical_usage_view_assignment.

WR2: An Interconnect_module_stratum_based_terminal shall be an assignment of a Land or Non_-functional_land in the case where a member of Stratum_concept_to_physical_usage_view_assignment references the Interconnect_module_stratum_based_terminal.

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4.2.387 Interconnect_module_surface_feature

An Interconnect_module_surface_feature is a type of Part_feature (see 4.2.494). An Interconnect_module_surface_feature is one of an Interconnect_module_edge_segment_surface (see 4.2.380), an Interconnect_module_primary_surface (see 5.2.4.146), or an Interconnect_module_secondary_surface (see 5.2.4.159). An Interconnect_module_surface_feature identifies a surface of the Interconnect_module (see 4.2.372) for fabrication and assembly purposes, particular to support Component_2d_location (see 4.2.83).

4.2.388 Interconnect_module_terminal

An Interconnect_module_terminal is a type of Part_terminal (see 4.2.502) and may be an Interconnect_module_stratum_based_terminal (see 5.2.4.79). The Interconnect_module_terminal identification is provided by the name attribute inherited from Shape_element (see 4.2.645). The string may include a substring that indicates to a person the connector the Interconnect_module_terminal is associated with. An Interconnect_module_terminal may be referenced by a member of Part_connected_terminals_definition (see 5.2.4.180) to identify a connection requirement for the Interconnect_module.

NOTE This part of ISO 10303 does not explicitly model, in a usage view, the relationship of a printed connector to an Interconnect_module in addition to the associated_definition relationship provided in this Application Object.

EXAMPLE 1 Figure 5.2.4.184 illustrates a detail of a usage view that shows an Interconnect_module_terminal that is a part of a edge finger connector.

The data associated with an Interconnect_module_terminal are the following:

— associated_definition;

— feature_shape ;

— terminal_connection_zone .

4.2.388.1 associated_definition

The associated_definition specifies the role of the Interconnect_module_usage_view (see 4.2.389) for the Interconnect_module_terminal.

4.2.388.2 feature_shape

The feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Interconnect_module_terminal. There shall be one or more Feature_shape_occurrence for an Interconnect_module_terminal.

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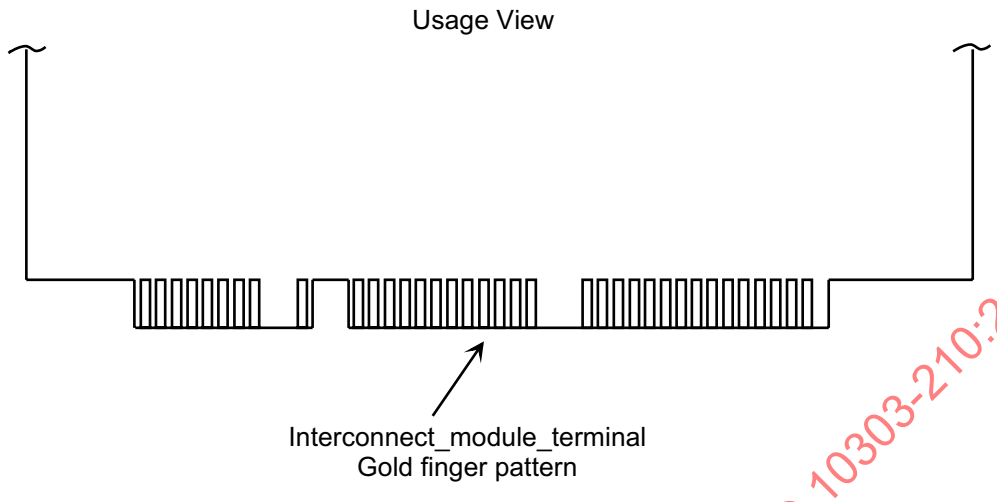

Figure 50 – Interconnect_module_terminal

4.2.388.3 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Interconnect_module_terminal. There may be more than one Connection_zone for an Interconnect_module_terminal.

NOTE The Feature_shape_occurrence (see 4.2.316) specified by the terminal or mounting feature may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is the Connection_zone.

4.2.389 Interconnect_module_usage_view

An Interconnect_module_usage_view is a type of Physical_unit_usage_view (see 4.2.538). An Interconnect_module_usage_view may be a Pcb_usage_view (see 5.2.4.188).

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The data associated with an Interconnect_module_usage_view are the following:

— implemented_function;

— located_thickness_requirement;

— maximum_thickness_over_dielectric_requirement;

— maximum_thickness_over_metal_requirement;

— measurement_condition;

— minimum_thickness_over_dielectric_requirement;

— minimum_thickness_over_metal_requirement.

4.2.389.1 implemented_function

The implemented_function specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Interconnect_module_usage_view. The implemented_function need not be specified for a particular Interconnect_module_usage_view.

4.2.389.2 located_thickness_requirement

The located_thickness_requirement specifies the role of the Located_interconnect_module_thickness_requirement (see 5.2.4.189) for the Interconnect_module_usage_view. A Located_interconnect_module_thickness_requirement need not be specified for an Interconnect_module_usage_view.

4.2.389.3 maximum_thickness_over_dielectric_requirement

The maximum_thickness_over_dielectric_requirement specifies the role of the Length_data_element (see 4.2.422) for the Interconnect_module_usage_view. The maximum_thickness_over_dielectric_requirement need not be specified for a particular Interconnect_module_usage_view.

4.2.389.4 maximum_thickness_over_metal_requirement

The maximum_thickness_over_metal_requirement specifies the role of the Length_data_element (see 4.2.422) for the Interconnect_module_usage_view. The maximum_thickness_over_metal_requirement need not be specified for a particular Interconnect_module_usage_view.

4.2.389.5 measurement_condition

The measurement_condition specifies the role of the Restraint_condition (see 5.2.4.192) for the Interconnect_module_usage_view. The measurement_condition need not be specified for a particular Interconnect_module_usage_view.

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4.2.389.6 minimum_thickness_over_dielectric_requirement

The minimum_thickness_over_dielectric_requirement specifies the role of the Length_data_element (see 4.2.422) for the Interconnect_module_usage_view. The minimum_thickness_over_dielectric_requirement need not be specified for a particular Interconnect_module_usage_view.

4.2.389.7 minimum_thickness_over_metal_requirement

The minimum_thickness_over_metal_requirement specifies the role of the Length_data_element (see 4.2.422) for the Interconnect_module_usage_view. The minimum_thickness_over_metal_requirement need not be specified for a particular Interconnect_module_usage_view.

Constraints:

WR1: At least one thickness property shall be provided.

4.2.390 Interface_component

An Interface_component is a type of Assembly_component (see 4.2.27) used to provide an identified interface in the assembly.

EXAMPLE 1 Figure 5.2.4.193 illustrates an Interface_component and its role in the assembly, and that there may be multiple Interface_component in sequence.

NOTE The interface provided by the Interface_component is usually included in the design to provide an interface between the component providing the primary interconnect functionality and other components or to the next level of assembly.

The data associated with an Interface_component are the following:

— access_mechanism.

4.2.390.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Interface_component is dependent on the existence of the Component_interface_terminal (see 4.2.97) that specifies the Interface_component as its associated_component. There shall be one or more Component_interface_terminal for an Interface_component.

4.2.391 Interface_component_allocation

An Interface_component_allocation is a type of Managed_design_object (see 4.2.431). An Interface_component_allocation is the assignment relationship between an Interface_component (see 4.2.390) on an assembly and the Mating_connector_component (see 5.2.4.200) to which the Interface_component must mechanically and electrically mate in the next assembly level.

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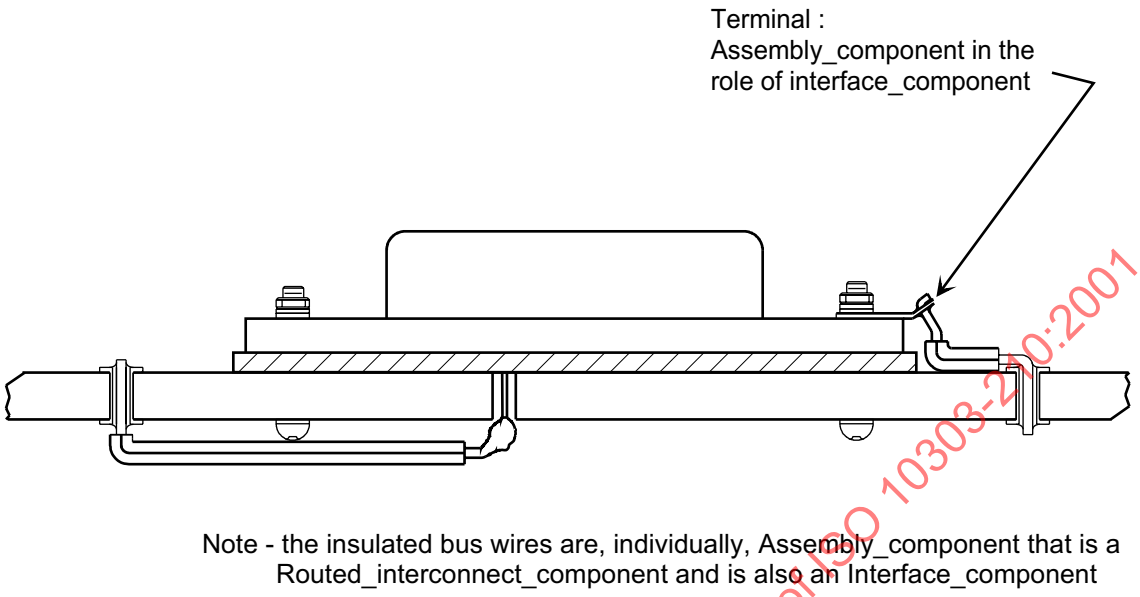

Figure 51 – Interface_component

The data associated with an Interface_component_allocation are the following:

— mating_requirement;

— mating_solution.

4.2.391.1 mating_requirement

The mating_requirement specifies the role of the Mating_connector_component (see 5.2.4.200) for the Interface_component_allocation.

4.2.391.2 mating_solution

The mating_solution specifies the role of the Interface_component (see 4.2.390) for the Interface_component_allocation.

4.2.392 Interface_mounted_join

An Interface_mounted_join is a type of Managed_design_object (see 4.2.431). An Interface_mounted_join is the relationship that specifies the connectivity between a terminal on a component and a terminal on the interface component in the assembly.

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EXAMPLE 1 An example of this relation is pin 1, a Component_terminal (see 4.2.105), on U1, an integrated circuit and a component, that is connected to pin 1, on XU1, a socket and an Interface_component (see 4.2.390), when the IC is inserted into the socket in the assembly.

The data associated with an Interface_mounted_join are the following:

— access_to_interface_mounted_component;

— connection_to_interconnect_module_component.

4.2.392.1 access_to_interface_mounted_component

The access_to_interface_mounted_component specifies the Component_terminal (see 4.2.105) of the Assembly_component (see 4.2.27) being interfaced to the assembly by the Interface_component (see 4.2.390) specified by connection_to_interconnect_module_component.

4.2.392.2 connection_to_interconnect_module_component

The connection_to_interconnect_module_component specifies the Component_interface_terminal (see 4.2.97) that mates with the Component_terminal (see 4.2.105) specified by access_to_interface_mounted_component. The Component_interface_terminal is a terminal of the Interface_component (see 4.2.390).

Constraints:

WR1: A Physical_connectivity_definition shall not specify a Component_terminal that participates in an Interface_mounted_join relationship as access_to_interface_mounted_component if that Physical_connectivity_definition specifies the Component_terminal of the associated Interface_component that completes connectivity to the board from the interface_mounted_component.

WR2: All members of Component_terminal specified by associated_terminals shall be in the same design view.

NOTE It is inappropriate to specify both the terminal on an IC plugged into a socket and the socket terminal in the same nodelist. It is unnecessary to specify the interface terminal on a socket in a nodelist, as the socket terminal is referenced by a member of Interface_mounted_join (see 5.2.4.208) that is referenced by a member of Physical_node_requirement_to_implementing_component_allocation (see 5.2.4.209) that references the original nodelist.

WR3: Both components whose terminals are being joined shall be for the same version of the Product.

4.2.393 Interface_requirement_occurrence

An Interface_requirement_occurrence is a type of Design_requirement_occurrence (see 5.2.4.175) in which the assembly interface to the next higher assembly is specified.

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The data associated with an Interface_requirement_occurrence are the following:

— interface_to_next_higher_assembly.

4.2.393.1 interface_to_next_higher_assembly

The interface_to_next_higher_assembly specifies the role of the Next_higher_assembly_interface_requirement (see 5.2.4.218) for the Interface_requirement_occurrence. This specifies the component in the next assembly that is the interface.

4.2.394 Interface_specification

An Interface_specification is a type of Design_specification (see 5.2.4.177) that describes the characteristics and constraints necessary for correct interoperation between specified units.

4.2.395 Interfaced_group_component

An Interfaced_group_component is a type of Assembly_group_component (see 4.2.31). An Interfaced_group_component includes one or more Interface_component (see 4.2.390) that interfaces a subset of that group of components to the assembly.

EXAMPLE 1 A component and a socket are both assigned to an Interfaced_group_component. The socket interfaces the other component to the assembly. Both the component and the socket are separately referenced and placed in the assembly.

The data associated with an Interfaced_group_component are the following:

— group_interface_component.

4.2.395.1 group_interface_component

The group_interface_component specifies the Interface_component (see 4.2.390) that interfaces the Interfaced_group_component to the assembly. There shall be one or more Interface_component for an Interfaced_group_component.

4.2.396 Interfacial_connection

An Interfacial_connection is a type of Via (see 4.2.761) that has both ends visible in the printed circuit board. Interfacial_connection is defined in IEC 60050-541.

EXAMPLE 1 Figure 5.2.4.221 illustrates an Interfacial_connection in a cross-section view of a substrate.

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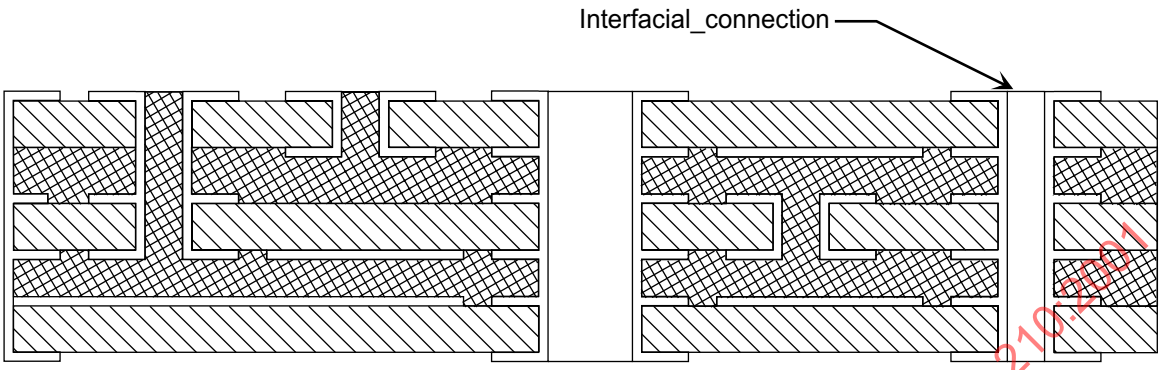

Figure 52 – Interfacial_connection

4.2.397 Internal_probe_access_area

An Internal_probe_access_area is a type of Probe_access_area (see 5.2.4.240) included in the design for access to internal conductors for probing purposes.

NOTE This is included explicitly because probe points are not usually included in a functional nodelist.

The data associated with an Internal_probe_access_area are the following:

— stratum_feature_implementation.

4.2.397.1 stratum_feature_implementation

The stratum_feature_implementation specifies the role of the Stratum_feature (see 4.2.683) for the Internal_probe_access_area. This Stratum_feature is included only to support the probe requirements and is not necessarily included in a functional nodelist.

Constraints:

WR1: Each member of Internal_probe_access_area shall be in the role of connected_probe for exactly one member of Inter_stratum_access.

WR2: The Stratum_feature specified by stratum_feature_implementation shall specify an external Stratum as a resident_stratum.

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4.2.398 Internal_stratum_access

An Internal_stratum_access is a type of Managed_design_object (see 4.2.431). An Internal_stratum_access is a relationship between an Internal_probe_access_area (see 5.2.4.232) and a Via (see 4.2.761) that provides access to a Stratum_feature (see 4.2.683) on an internal Design_layer_stratum (see 5.2.4.382). This Application Object is part of a logical structure to identify the special usage of a Via in support of accessing internal conductors in the design.

The data associated with an Internal_stratum_access are the following:

— connected_probe;

— inter_stratum_feature.

4.2.398.1 connected_probe

The connected_probe specifies the Internal_probe_access_area (see 5.2.4.232) that provides probe access to a Stratum_feature (see 4.2.683) on an internal Design_layer_stratum (see 5.2.4.382) for the Internal_-stratum_access.

4.2.398.2 inter_stratum_feature

The inter_stratum_feature specifies the Via (see 4.2.761) that provides electrical connectivity to the Stratum_feature (see 4.2.683) to be probed for the Internal_stratum_access. The external surface of the Via is the area the test probe mates with in a test setup.

Constraints:

UR1: The combination of the connected_probe and the inter_stratum_feature shall be unique within a population of Internal_stratum_accesses.

4.2.399 Intra_stratum_join_relationship

An Intra_stratum_join_relationship is a type of Join_relationship (see 5.2.4.34) in which all joins occur on one Design_layer_stratum (see 5.2.4.382).

The data associated with an Intra_stratum_join_relationship are the following:

— ordered_implementation;

— random_implementation.

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4.2.399.1 ordered_implementation

The ordered_implementation is an inverse relationship that specifies the Conductor (see 5.2.4.162) that specifies the Intra_stratum_join_relationship as its implementation_requirement. There shall be no more than one Conductor for an Intra_stratum_join_relationship. The use of "ordered" in this context shall be interpreted as "having a distinct structure by design". It does not indicate a strictly linear sequence.

4.2.399.2 random_implementation

The random_implementation is an inverse relationship that specifies the Connected_filled_area (see 5.2.4.153) that specifies the Intra_stratum_join_relationship as its implementation_requirement. There shall be no more than one Connected_filled_area for an Intra_stratum_join_relationship. The use of "random" in this context shall be interpreted as "having no intrinsic structure by design".

Constraints:

WR1: All Layer_connection_points specified shall be on the same Design_layer_stratum.

WR2: At least one ordered_implementaton or random_implementation shall exist for a population of Intra_stratume_join_relationship.

4.2.400 Item_restricted_requirement_occurrence

An Item_restricted_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283). The Item_restricted_requirement_occurrence provides the ability for a design organization to track the dependency of a requirement on a specific design object.

EXAMPLE 1 Thermal requirements may, for example, be dependent on the processor module or the drive motor.

The data associated with an Item_restricted_requirement_occurrence are the following:

— basis.

4.2.400.1 basis

The basis specifies the role of one of an Assembly_component (see 4.2.27), a Component_external_reference (see 4.2.89), a Component_feature (see 4.2.90); or a Component_feature_external_reference (see 4.2.91); or one of an Ee_requirement_occurrence (see 4.2.283), a Stratum (see 4.2.677); or one of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) for the Item_restricted_requirement_occurrence. The basis is the reference design object for the requirement.

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4.2.401 Join_relationship

A Join_relationship is a type of Managed_design_object (see 4.2.431). A Join_relationship is either an Inter_stratum_join_relationship (see 5.2.4.33) or an Intra_stratum_join_relationship (see 5.2.4.354). A Join_relationship identifies a strict subset of the Layer_connection_point (see 5.2.4.420) identified by Physical_network (see 5.2.4.17) topology. This subset is then inherited by both types of Join_relationship to ensure topological integrity.

The data associated with a Join_relationship are the following:

— network_topology;

— points_to_be_connected.

4.2.401.1 network_topology

The network_topology is an inverse relationship that specifies that the existence of the Join_relationship is dependent on the existence of the Physical_network (see 5.2.4.17) that specifies the Join_relationship as its interconnect_module_network_topology.

4.2.401.2 points_to_be_connected

The points_to_be_connected specifies the role of the Layer_connection_point (see 5.2.4.420) for the Join_relationship. There shall be at least two Layer_connection_point in a Join_relationship.

4.2.402 Join_two_physical_connectivity_definition_supporting_printed_component

A Join_two_physical_connectivity_definition_supporting_printed_component is a type of Printed_component (see 5.2.4.246). The Join_two_physical_connectivity_definition_supporting_printed_component is included specifically for cases in which analog and digital grounds are kept topologically and physically separate completely through the design process to minimize noise but need to be physically connected for reference voltage purposes.

NOTE This connections is usually required to be at one and only one location.

The data associated with a Join_two_physical_connectivity_definition_supporting_printed_component are the following:

— joined_definitions.

4.2.402.1 joined_definitions

The joined_definitions specify the roles of exactly two Physical_connectivity_definition (see 5.2.4.1) for the Join_two_physical_connectivity_definition_supporting_printed_component.

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4.2.403 Junction_vertex_allocation

A Junction_vertex_allocation is a type of Managed_design_object (see 4.2.431). A Junction_vertex_-allocation is the relationship that specifies one or more Layer_connection_point (see 5.2.4.420) to which a Topological_junction (see 5.2.4.205) is mapped during the layout routing process. A Junction_vertex_-allocation is the result of an assignment process by a designer or a layout routing process that defines the location of Inter_stratum_join_relationship (see 5.2.4.33) or Explicitly_located_layer_connection_point (see 5.2.4.185).

The data associated with a Junction_vertex_allocation are the following:

— implementation_point;

— required_vertex.

4.2.403.1 implementation_point

The implementation_point specifies either the Inter_stratum_join_relationship (see 5.2.4.33) or Explicitly_located_layer_connection_point (see 5.2.4.185) that, individually, maps the requirement that a junction participates in a connectivity onto points on conducting Stratum (see 4.2.677) for the Junction_vertex_allocation.

NOTE 1 This construct allows the Junction_vertex_allocation to consider an Inter_stratum_join_relationship to be a vertex.

NOTE 2 The Junction_vertex_allocation allows for the specification of the location of the connections between physical traces and connected areas. It is common practice for the point where a trace, via, pad, etc., connects with other features to be specified by the designer interactively during layout. This location may be constrained for fabrication, layout, or signal integrity purposes. The Junction_vertex allocation specifies these relationships.

4.2.403.2 required_vertex

The required_vertex specifies the Topological_junction (see 5.2.4.205), as a vertex of a Physical_connectivity_definition (see 5.2.4.1), that is to be mapped to an implementation_point by the Junction_vertex_allocation.

Constraints:

UR1: The required_vertex shall be unique within a population of Junction_vertex_allocations.

WR1: The implementation_point and required_vertex shall be within the same design view.

WR2: The implementation_point and required_vertex shall be within the scope of the same Physical_-network (see 5.2.4.17).

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4.2.404 Laminate_component

A Laminate_component is a type of Assembly_component (see 4.2.27). A Laminate_component may be one of a Conductive_interconnect_element (see 5.2.4.154), an Inter_stratum_feature (see 4.2.364), a Laminate_text_component (see 5.2.4.256), a Laminate_text_string_component (see 4.2.406), a Printed_component (see 5.2.4.246), a Probe_access_area (see 5.2.4.240), a Routed_printed_component (see 5.2.4.258), a Special_symbol_laminate_component (see 4.2.667) or a Stratum_feature_template_component (see 5.2.4.161), or additionally may be a Fiducial (see 5.2.4.277), or additionally may be a Physical_laminate_component (see 5.2.4.262). All types of Laminate_component are realized as part of the manufacturing process that produces the interconnect.

The data associated with a Laminate_component are the following:

— cad_layer;

— usage_definition.

NOTE Complex multi-layered components should be described by using the Assembly_group_component and Sub_assembly_component_relationship. These relationships will be created from occurrences of Stratum_feature_template_component or other Printed_component occurrences.

4.2.404.1 cad_layer

The cad_layer specifies the role of the External_definition (see 4.2.304) for the Laminate_component. The cad_layer need not be specified for a Laminate_component.

NOTE The cad_layer attribute is provided to support design archival within an exterprise.

4.2.404.2 usage_definition

The usage_definition specifies the role of the Part_template (see 4.2.498) for the Laminate_component.

4.2.405 Laminate_text_component

A Laminate_text_component is a type of Laminate_component (see 4.2.404) that is designed to be interpreted as a single character portion of a text message by a human or by an artificial vision system. A Laminate_text_component may be used to help compose a Laminate_text_string_component (see 4.2.406) to form a complete message. The composition will be defined by an instance of Assembly_group_component (see 4.2.31) that relates all necessary members of Laminate_component to compose the message embodied in the instance of Laminate_text_string_component. Each Stratum_feature referenced by the stratum_feature_implementation shall be on the same Stratum (see 4.2.677).

EXAMPLE 1 Figure 5.2.4.265 illustrates possible arrangements and orientation of the Laminate_text_string_component in the material of the Stratum (see 4.2.677). The figure includes multiple Laminate_text_component members presenting characters.

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The data associated with a Laminate_text_component are the following:

— of_character;

— stratum_feature_implementation;

— usage_definition.

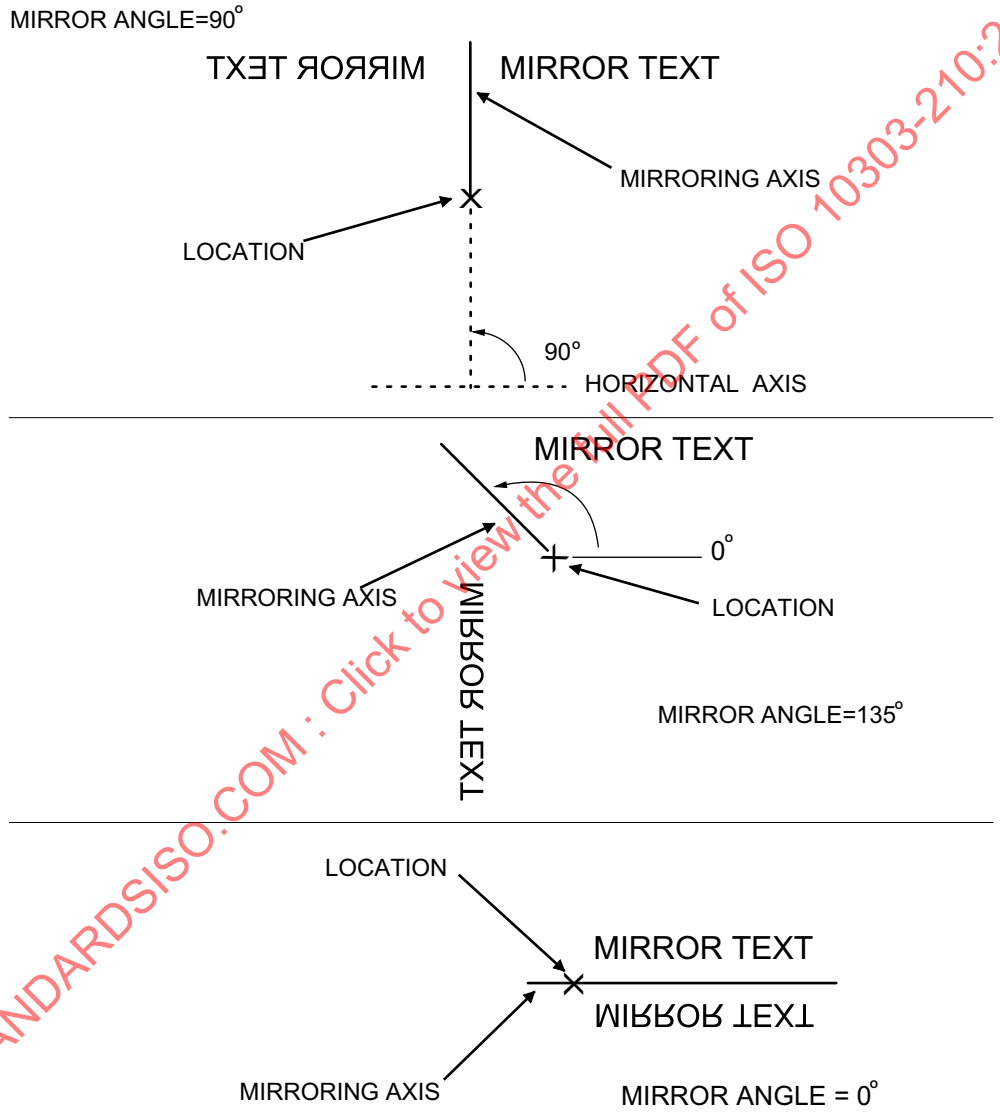

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Figure 53 – Laminate_text_component

4.2.405.1 of_character

The of_character specifies the message content, a character, for the Laminate_text_component.

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4.2.405.2 stratum_feature_implementation

The stratum_feature_implementation specifies the role of the Stratum_feature (see 4.2.683) for the Laminate_text_component. There may be more than one Stratum_feature for the Laminate_text_component.

NOTE Multiple Stratum_feature may exist in the case that the shape of the character is disjoint, but they are all on the same Stratum.

4.2.405.3 usage_definition

The usage_definition specifies the Part_text_template (see 5.2.4.282) that contains the font definition and associated parameters to be used for the Laminate_text_component.

4.2.406 Laminate_text_string_component

A Laminate_text_string_component is a type of Laminate_component (see 4.2.404) and is a type of Array_placement_group (see 4.2.22). A Laminate_text_string_component conveys a complete one line message to the viewer. A Laminate_text_string_component is composed by associating one or more individual instances of Laminate_text_component (see 5.2.4.256) to the Laminate_text_string_component using one instance of Sub_assembly_relationship (see 4.2.707). The Laminate_text_string_component itself does not directly refer to a font definition. The usage_definition inherited from the supertype Assembly_component (see 4.2.27) is unnecessary since this Application Object is defined by the composition of Laminate_text_component contributing to it. The position of the Laminate_text_string_component shall be interpreted as a constraint on the position of the individual components contributing to it. The position of the Laminate_text_string_component shall be interpreted as the insertion point for the message. The Laminate_text_string_component may have an orientation with respect to the design coordinate system, in which case the components composing the Laminate_text_string_component shall have a corresponding orientation. The Axis_placement (see 4.2.43) or Cartesian_transformation_operator_2d (see 4.2.68) which locates the Laminate_text_string_component shall be interpreted as a local coordinate system in order that any orientation shall be applied consistently to all components. An implementation shall ensure that adjacent characters that use different fonts still meet the requirement that Stratum_feature (see 4.2.683) instances are disjoint.

NOTE If multi-line messages are required, multiple instances of Laminate_text_string_component will be needed, one for each line of the message.

The data associated with a Laminate_text_string_component are the following:

— message;

— of_horizontal_justification;

— of_vertical_justification.

4.2.406.1 message

The message specifies the message content, a string, for the Laminate_text_string_component.

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4.2.406.2 of_horizontal_justification

The horizontal_justification specifies either "left", "right", or "centre" for the beginning point of the message with respect to the position of the Axis_placement (see 4.2.43) or Cartesian_transformation_-operator_2d (see 4.2.68) that is the insertion point for the text. The "left" indicates that the left edge of the bounding box of the first character of the message is aligned with the 'Y' axis of the Axis_placement. The "right" indicates that the right edge of the bounding box of the last character of the message is aligned with the 'Y' axis of the Axis_placement. The "centre" indicates that the left edge of the bounding box of the first character of the message and the right edge of the bounding box of the last character of the message are equally displaced on either side of the 'Y' axis of the Axis_placement.

4.2.406.3 of_vertical_justification

The vertical_justification specifies either "top", "bottom", or "centre" for the beginning point of the message with respect to the position of the Axis_placement (see 4.2.43) or Cartesian_transformation_-operator_2d (see 4.2.68) that is the insertion point for the text. The "top" indicates that the top edge of the bounding box of the first character of the message is aligned with the 'X' axis of the Axis_placement. The "bottom" indicates that the bottom edge of the bounding box of the last character of the message is aligned with the 'X' axis of the Axis_placement. The "centre" indicates that the top edge of the bounding box of the first character of the message and the bottom edge of the bounding box of the last character of the message are equally displaced on either side of the 'X' axis of the Axis_placement.

4.2.407 Land

A Land is a type of Stratum_feature_template_component (see 5.2.4.161). A Land may be a Component_termination_passage_and_contact_size_dependent_land (see 5.2.4.254), a Component_termination_passage_dependent_land (see 5.2.4.64), a Contact_size_dependent_land (see 5.2.4.235), a Via_dependent_land (see 5.2.4.285), or a Via_and_contact_size_dependent_land (see 5.2.4.287). A Land is defined in IEC 60050-541. A land is an interface to a PCB or to a PWB, and therefore includes an external access mechanism and an internal access mechanism that are modeled as distinct Application Objects. A Land helps compose a Conductor or a Conductive_filled_area.

EXAMPLE 1 Figure 5.2.4.288 illustrates the relationship of a Land to the other elements of a construction known in the domain as a padstack.

The data associated with a Land are the following:

— access_mechanism;

— alternate_land_definition;

— interface_access_mechanism;

— usage_definition.

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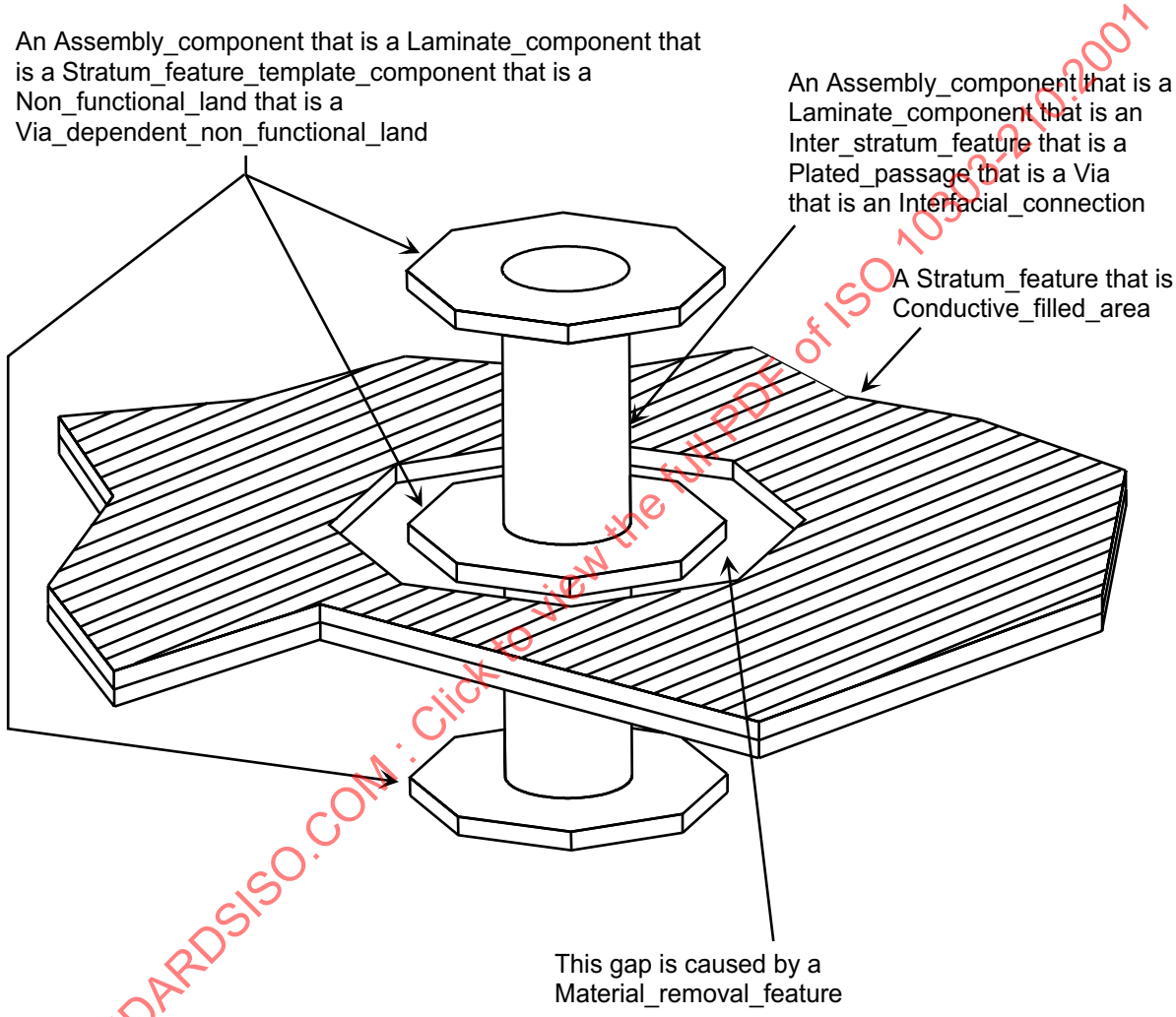

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Figure 54 – Land

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4.2.407.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Land is dependent on the existence of the Land_join_terminal (see 5.2.4.12) that specifies the Land as its associated_component. There shall be one or more Land_join_terminal for a Land. This relationship is for internal access only.

4.2.407.2 alternate_land_definition

The alternate_land_definition specifies one role of the Land_physical_template (see 5.2.4.85) for the Land. The alternate_land_definition need not be specified for a particular Land.

4.2.407.3 interface_access_mechanism

The interface_access_mechanism is an inverse relationship that specifies that the existence of the Land is dependent on the existence of the Land_interface_terminal (see 4.2.408) that specifies the Land as its associated_component. This relationship is for external access only.

4.2.407.4 usage_definition

The usage_definition specifies the primary role of the Land_physical_template (see 5.2.4.85) for the Land.

Constraints:

WR1: A member of land shall be directly connected to a member of conductive_interconnect_element.

WR2: When an alternate_land_definition is present it overrides the usage_definition for the Land.

4.2.408 Land_interface_terminal

A Land_interface_terminal is a type of Component_feature (see 4.2.90) included to identify the interface available to be fastened to in the next level of assembly.

The data associated with a Land_interface_terminal are the following:

— associated_component;

— definition.

4.2.408.1 associated_component

The associated_component specifies the role of the Land (see 4.2.407) for the Land_interface_terminal.

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4.2.408.2 definition

The definition specifies the role of the Land_template_interface_terminal (see 5.2.4.307) for the Land_-interface_terminal.

NOTE Use of this capability occurs when a member of Component_feature_to_physical_usage_view_assignment references a member of Land_interface_terminal to define a traceability relationship to an Interconnect_-module_terminal.

4.2.409 Land_join_terminal

A Land_join_terminal is a type of Component_terminal (see 4.2.105) included in the design to mate directly with a terminal of another fabricated feature by use of a Fabrication_joint (see 5.2.4.396) internally in a layout.

The data associated with a Land_join_terminal are the following:

— associated_component;

— definition.

4.2.409.1 associated_component

The associated_component specifies the role of the Land (see 4.2.407) for the Land_join_terminal.

4.2.409.2 definition

The definition specifies the role of the Land_template_join_terminal (see 5.2.4.311) for the Land_join_-terminal.

Constraints:

WR1: A Land_join_terminal shall participate in a relationship with a Fabrication_joint as a fabrication_features.

4.2.410 Land_physical_template

A Land_physical_template is a type of Stratum_feature_template (see 5.2.4.317). A Land_physical_-template may be a Default_land_physical_template (see 5.2.4.95). If the material the Land_physical_-template is composed of it conductive, the Land_physical_template provides the functionality of a short among its terminals.

EXAMPLE 1 Figure 55 illustrates explicit geometry that represents simplified Land_physical_template.

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The data associated with a Land_physical_template are the following:

— access_mechanisms;

— pre_defined_classification_code.

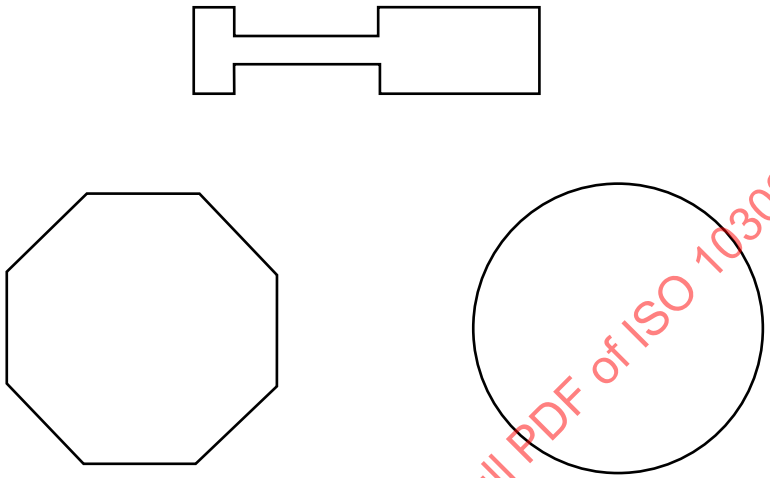

Figure 55 – Custom designs for Land_physical_template

4.2.410.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Land_physical_template is dependent on the existence of the Land_template_terminal (see 4.2.413) that specifies the Land_physical_template as its associated_definition. There shall be two or more Land_template_terminal for a Land_physical_template. Fabrication and assembly tolerances define the required shapes and variances for the terminal shapes.

4.2.410.2 pre_defined_classification_code

The pre_defined_classification_code specifies the role of the External_definition (see 4.2.304) for the Land_physical_template. The pre_defined_classification_code need not be specified for a specific Land_physical_template.

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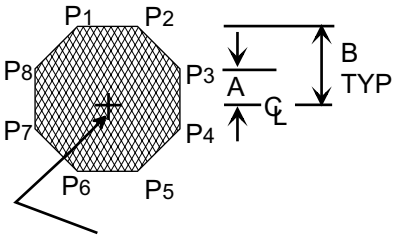
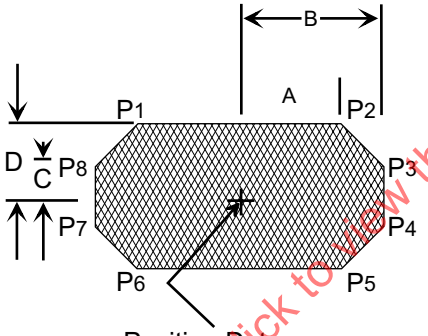


Position Datum represented by Axis_placement

Parameters
A = Distance to Position Datum Center Line to P1,P2,P3,P4 P5,P6,P7 and P8
B = Distance from Position Datum Center Line to Outside Edge (P1,P2) (P3,P4),(P5,P6),(P7,P8)

Variable Octagon



Position Datum represented by Axis_placement

Parameters
A = Distance from Position Datum Center Line to P1,P2,P5,P6.
B = Distance from Position Datum Center Line to Outside Edge(P3,P4) (P7,P8)
A = Distance from Position Datum Center Line to P3,P4, P7,P8
B = Distance from Position Datum Center Line to Outside Edge (P1,P2) (P4,P5)

Variable Elongated Octagon

Physical characteristics are inherited from Part_template.
Reference document is : IEC 61182-1

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Figure 56 – Complex land template shapes

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NOTE 1 IEC 61182-1 provides a set of Land (see 4.2.407) identifiers. See figure 56.

NOTE 2 The Land_template, Usage_concept_usage_relationship (see 4.2.757), and the Geometric Dimensioning and Tolerancing capabilities of this part of ISO 10303 may be used to unambiguously exchange the shape of both pre-defined Land patterns that include only geometry (as from IEC 61182-1) and enterprise defined patterns. When this facility is used to create more than one equivalent Land definition, it may not be possible to maintain knowledge of the connection functionality of the Land definition. This is because Land is an atomic concept in this part of ISO 10303.

NOTE 3 The Assembly_group_component (see 4.2.31), Interconnect_module (see 4.2.372), and the Geometric Dimensioning and Tolerancing capabilities of this part of ISO 10303 may be used to unambiguously exchange both the shape and connection knowledge of Land patterns that include pre-defined geometry (as from IEC 61182-1) and enterprise defined geometry that have explicit definitions of the fabrication and assembly constraints.

NOTE 4 The Land_physical_template inherit material property data from Part_template.

Constraints:

UR1: The pre_defined_classification_code shall be unique within a population of Land_physical_templates.

4.2.411 Land_template_interface_terminal

A Land_template_interface_terminal is a type of Land_template_terminal (see 4.2.413) that has an external access functionality.

EXAMPLE 1 Figure 5.2.4.318 is a plan view that illustrates the geometry that represents the interface terminal for a Land_physical_template (see 5.2.4.85).

NOTE External refers to something that is outside of the product that an occurrence is helping to compose.

4.2.412 Land_template_join_terminal

A Land_template_join_terminal is a type of Land_template_terminal (see 4.2.413) that has an internal access functionality.

EXAMPLE 1 Figure 5.2.4.344 is a plan view that illustrates the geometry that represents the join terminal for a Land_physical_template (see 5.2.4.85). In the plan view, the join terminal is on the periphery.

NOTE Internal refers to something that is intrinsic to the product of which an occurrence is part.

4.2.413 Land_template_terminal

A Land_template_terminal is a type of Managed_design_object (see 4.2.431). A Land_template_terminal is either a Land_template_interface_terminal (see 5.2.4.307) or a Land_template_join_terminal (see 5.2.4.311).

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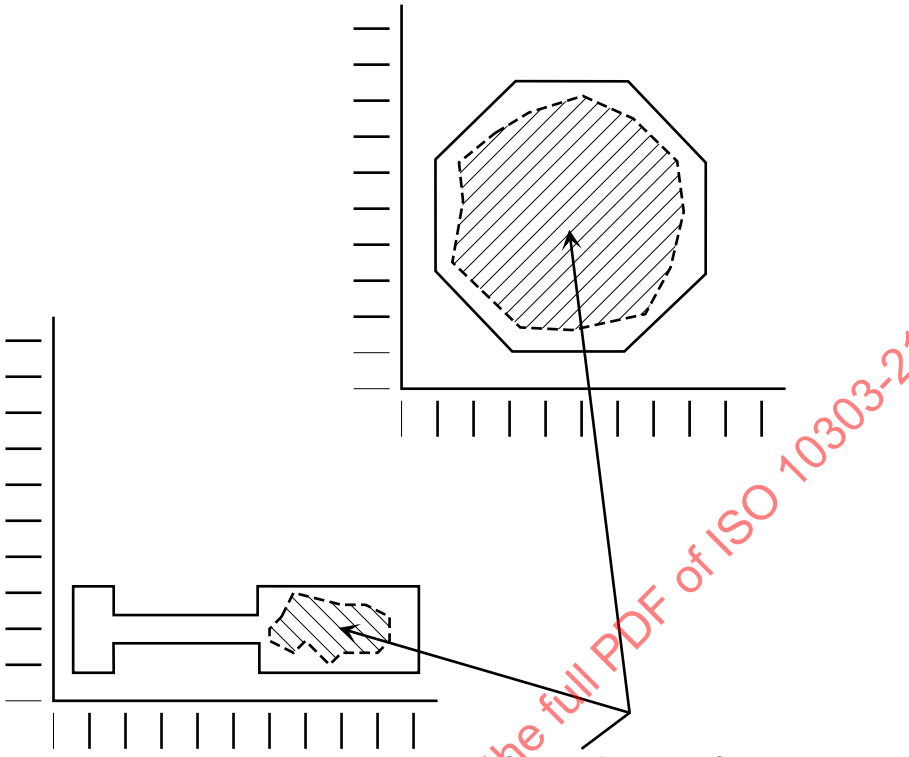

Figure 57 – Land_template_interface_terminal

The data associated with a Land_template_terminal are the following:

— associated_definition;

— connection_zone_category;

— name;

— terminal_connection_zone.

4.2.413.1 associated_definition

The associated_definition specifies the role of the Land_physical_template (see 5.2.4.85) for the Land_-template_terminal.

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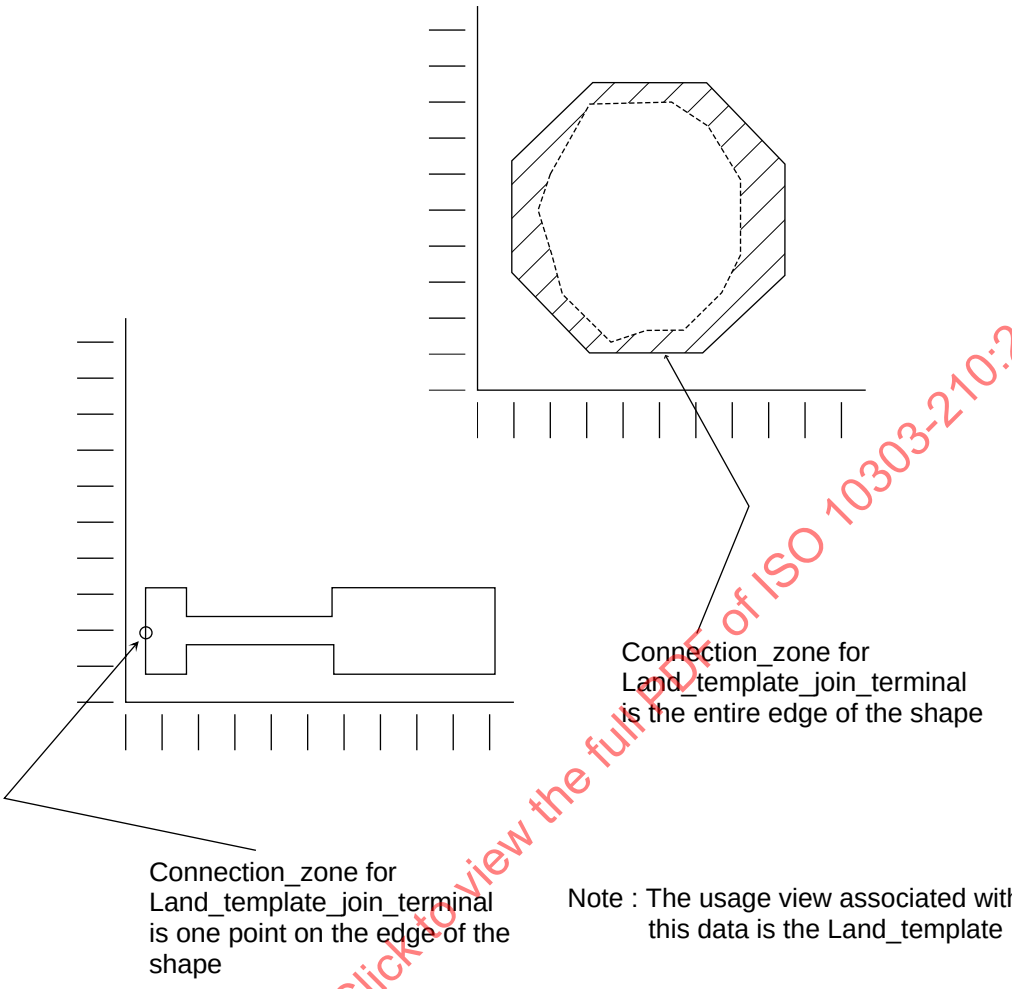

Figure 58 – Land_template_join_terminal

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4.2.413.2 connection_zone_category

The connection_zone_category specifies either an edge_curve, an edge_point, a surface_area, or a surface_point as a category of the Connection_zone (see 4.2.147) for the Land_template_terminal.

4.2.413.3 name

The name identifies the Land_template_terminal.

4.2.413.4 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Land_-template_terminal. There shall be one or more Connection_zone for the Land_template_terminal.

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Constraints:

UR1: The combination of the associated_definition and the name shall be unique within a population of Land_template_terminals.

WR1: The points comprising the terminal_connection_zone must reside in the shape of the electrical device being accessed.

WR2: The points comprising the terminal_connection_zone shall be defined in the coordinate system of the device being accessed.

4.2.414 Language_reference_manual

A Language_reference_manual is a type of Ee_specification (see 4.2.292) that defines the syntax and semantics of a computer interpretable language.

4.2.415 Layer

A Layer is a type of Managed_design_object (see 4.2.431). A Layer is an extent of contiguous Stratum (see 4.2.677) in a printed circuit board. The Stratum_feature (see 4.2.683) of all Stratum of a Layer are as alike in shape as process tolerances will allow; the design intent is that the shapes of the Stratum_-features are to be identical. Standard usage is for exactly one of a Design_layer_stratum (see 5.2.4.382) or Documentation_layer_stratum (see 5.2.4.62) to be included in the Inter_stratum_extent (see 5.2.4.83) referenced by extent.

The data associated with a Layer are the following:

— extent;

— layer_usage;

— name.

4.2.415.1 extent

The extent specifies the role of the Inter_stratum_extent (see 5.2.4.83) for the Layer.

4.2.415.2 layer_usage

The layer_usage specifies the External_definition (see 4.2.304) that characterizes the purpose for incorporating the Layer into a Interconnect_module (see 4.2.372) design. The layer_usage need not be specified for a particular Layer.

4.2.415.3 name

The name identifies the Layer within the product.

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Constraints:

UR1: The name shall be unique within a population of Layers for a product.

WR1: Each member of Stratum specified by Layer shall be represented by the same geometric representation.

WR2: Each member of Layer shall be related to no more than one Design_layer_stratum or no more than one Documentation_layer_stratum.

4.2.416 Layer_connection_point

A Layer_connection_point is a type of Managed_design_object (see 4.2.431). A Layer_connection_point is either a Dependently_located_layer_connection_point (see 5.2.4.157) or an Explicitly_located_layer_connection_point (see 5.2.4.185) that resides on the surface of a Design_layer_stratum (see 5.2.4.382) in the Interconnect_module (see 4.2.372) and is defined in the coordinate system of the Interconnect_module. The Layer_connection_point Application Object is an intersection concept between the topology requirements, placement requiremets defined in a geometric coordinate system and the Stratum material definition.

The data associated with a Layer_connection_point are the following:

— join_path;

— name;

— resident_design_layer_stratum.

4.2.416.1 join_path

The join_path is an inverse relationship that specifies that the existence of the Layer_connection_point is dependent on the existence of the Join_relationship (see 5.2.4.34) that specifies the Layer_connection_point as its points_to_be_connected. There shall be one or more Join_relationship for a Layer_connection_point.

4.2.416.2 name

The name identifies a Layer_connection_point.

4.2.416.3 resident_design_layer_stratum

The resident_design_layer_stratum specifies the Design_layer_stratum (see 5.2.4.382) upon which the Layer_connection_point is located.

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Constraints:

UR1: The name shall be unique within a population of Layer_connection_point.

WR1: For each member of Cartesian_point associated with a Design_layer_stratum, there shall be no more than one Layer_connection_point associated with that Cartesian_point.

WR2: Each member of Layer_connection_point shall be specified by no more than one member of Physical_network.

4.2.417 Layer_connection_point_link

A Layer_connection_point_link is a type of Managed_design_object (see 4.2.431). A Layer_connection_point_link is a directed link between two Layer_connection_point (see 5.2.4.420) in order to support the sequence of Layer_connection_point required in Conductive_interconnect_element_with_pre_-defined_transitions (see 5.2.4.419).

The data associated with a Layer_connection_point_link are the following:

— precedent_point;

— subsequent_point.

4.2.417.1 precedent_point

A precedent_point specifies one role of the Layer_connection_point (see 5.2.4.420) for a Layer_connection_point_link.

4.2.417.2 subsequent_point

A subsequent_point specifies one role of the Layer_connection_point (see 5.2.4.420) for a Layer_connection_point_link.

Constraints:

WR1: The precedent_point shall not be the subsequent_point.

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4.2.418 Layer_qualified_layout_spacing_requirement_occurrence

A Layer_qualified_layout_spacing_requirement_occurrence is a type of Layout_spacing_requirement_-occurrence (see 5.2.4.42) that describes the physical spacing between one of an interconnect_module_-cutout, an interconnect_module_fill_area, an interconnect_module_inter_stratum_feature, an interconnect_module_stratum_feature, or an interconnect_module_via, and another of these categories of design objects. This Application object qualifies the spacing requirement to apply within a given context as defined by a set of Stratum (see 4.2.677).

The category names correspond to the category of equivalent application object names as described in Layout_spacing_requirement_occurrence. This requirement shall be interpreted as applying to the categories of those objects.

NOTE A pair of categories is used for this requirement occurrence.

EXAMPLE 1 In domain terms, when a Via to Via spacing is to be greater than 5 mm, the encoding will be that the spacing between the reference_design_object_category whose value is interconnect_module_via and the dependent_design_object_category whose value is interconnect_module_via shall be greater than 5 mm.

EXAMPLE 2 In domain terms, when the distance from a cutout to a trace must be greater than 5 mm, the encoding will be that the spacing between the reference_design_object_category whose value is interconnect_-module_cutout and the dependent_design_object_category whose value is interconnect_module_stratum_feature shall be greater than 5 mm.

The data associated with a Layer_qualified_layout_spacing_requirement_occurrence are the following:

— layer_context.

4.2.418.1 layer_context

The layer_context specifies an Inter_stratum_extent (see 5.2.4.83), for the Layer_qualified_layout_spacing_requirement_occurrence. The layer_context establishes a context within which the spacing requirement is to be met. There may be more than one Inter_stratum_extent for a Layer_qualified_layout_spacing_requirement_occurrence. The Inter_stratum_extent may overlap. All Inter_stratum_extent specified shall be in the same design.

4.2.419 Layout_spacing_requirement_non_conforming_design_object

A Layout_spacing_requirement_non_conforming_design_object is a type of Managed_design_object (see 4.2.431). A Layout_spacing_requirement_non_conforming_design_object specifies one or more design object that does not meet object to object spacing requirements for the printed circuit board layout.

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The data associated with a Layout_spacing_requirement_non_conforming_design_object are the following:

— design_requirement;

— non_conformant_design_object;

— reference_design_object.

4.2.419.1 design_requirement

The design_requirement specifies the role of the Layout_spacing_requirement_occurrence (see 5.2.4.42) for the Layout_spacing_requirement_non_conforming_design_object

4.2.419.2 non_conformant_design_object

The non_conformant_design_object specifies one role of either an Assembly_component (see 4.2.27), a Component_feature (see 4.2.90), or one of a Component_termination_passage (see 5.2.4.227), a Conductive_filled_area (see 5.2.4.365), a Conductor (see 5.2.4.162), a Cutout (see 5.2.4.31), an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Land (see 4.2.407), a Non_functional_land (see 5.2.4.274), a Stratum_feature (see 4.2.683), or a Via (see 4.2.761) for the Layout_spacing_requirement_non_conforming_design_object. There shall be one or more Assembly_component, Component_feature, Component_termination_passage, Conductive_filled_area, Conductor, Cutout, Inter_stratum_feature, Laminate_component, Land, Non_functional_land, Stratum_feature, or Via for each Layout_spacing_requirement_non_conforming_design_object.

4.2.419.3 reference_design_object

The reference_design_object specifies one role of either an Assembly_component (see 4.2.27), a Component_feature (see 4.2.90), or one of a Component_termination_passage (see 5.2.4.227), a Conductive_filled_area (see 5.2.4.365), a Conductor (see 5.2.4.162), a Cutout (see 5.2.4.31), an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Land (see 4.2.407), a Non_functional_land (see 5.2.4.274), a Stratum_feature (see 4.2.683), or a Via (see 4.2.761) for the Layout_spacing_requirement_non_conforming_design_object.

NOTE This data is the result of an evaluation of the difference between the board layout and the original spacing requirements.

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4.2.420 Layout_spacing_requirement_occurrence

A Layout_spacing_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that describes the physical spacing between one of an assembly_module_assembly_component, an assembly_module_component_feature, an interconnect_module_cutout, an interconnect_module_fill_area, an interconnect_module_inter_stratum_feature, an interconnect_module_stratum_feature, an interconnect_module_via, or a part_altered_package, and another of these categories of design objects. A Layout_spacing_requirement_occurrence may be a Layer_qualified_layout_spacing_requirement_occurrence. The requirement shall be imposed between the boundaries of members of the the relevant categories.

The category names correspond to the category of equivalent application object names. Assembly_module_assembly_component corresponds to Assembly_component (see 4.2.27) category. Assembly_module_component_feature corresponds to Component_feature (see 4.2.90) category. Interconnect_module_cutout corresponds to Cutout (see 5.2.4.31) category. Interconnect_module_fill_area corresponds to Fill_area (see 5.2.4.327) category. Interconnect_module_inter_stratum_feature corresponds to Inter_stratum_feature (see 4.2.364) category. Interconnect_module_stratum_feature corresponds to Stratum_feature (see 4.2.683) category. Interconnect_module_via corresponds to Via (see 4.2.761) category. Part_altered_package corresponds to Altered_package (see 4.2.5) category.

NOTE A pair of categories is used for this requirement occurrence.

EXAMPLE 1 In domain terms, when a Via to Via spacing is to be greater than 5 mm, the encoding will be that the spacing between the reference_design_object_category whose value is interconnect_module_via and the dependent_design_object_category whose value is interconnect_module_via shall be greater than 5 mm.

EXAMPLE 2 In domain terms, when the distance from a cutout to a trace must be greater than 5 mm, the encoding will be that the spacing between the reference_design_object_category whose value is interconnect_module_cutout and the dependent_design_object_category whose value is interconnect_module_stratum_feature shall be greater than 5 mm.

The data associated with a Layout_spacing_requirement_occurrence are the following:

— dependent_design_object_category;

— reference_design_object_category.

4.2.420.1 dependent_design_object_category

The dependent_design_object_category specifies one role of either an assembly_module_assembly_component, an assembly_module_component_feature, an interconnect_module_cutout, an interconnect_module_fill_area, an interconnect_module_inter_stratum_feature, an interconnect_module_stratum_feature, an interconnect_module_via, or a part_altered_package, for the Layout_spacing_requirement_occurrence.

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4.2.420.2 reference_design_object_category

The reference_design_object_category specifies one role of either an assembly_module_assembly_component, an assembly_module_component_feature, an interconnect_module_cutout, an interconnect_module_fill_area, an interconnect_module_inter_stratum_feature, an interconnect_module_stratum_feature, an interconnect_module_via, or a part_altered_package, for the Layout_spacing_requirement_occurrence.

Constraints:

UR1: The combination of the reference_design_object_category and the dependent_design_object_category shall be unique within a population of Layout_spacing_requirement_occurrences.

4.2.421 Lead_form_specification

A Lead_form_specification is a type of Process_specification (see 4.2.589) that describes the process to modify the shape property of a Part_terminal (see 4.2.502).

4.2.422 Length_data_element

A Length_data_element is a type of Data_element (see 4.2.173) where the measurement is of distance. A member of Length_data_element may also be a member of Qualified_data_element (see 4.2.606) in order to convey uncertainty.

4.2.423 Length_trimmed_terminal

A Length_trimmed_terminal is a type of Altered_package_terminal (see 4.2.6). A Length_trimmed_terminal describes the prepared length of a terminal accomplished prior to its assembly to the printed circuit assembly. The prepared length is equivalent to the as delivered length.

The data associated with a Length_trimmed_terminal are the following:

— maximum_trimmed_length;

— minimum_trimmed_length.

4.2.423.1 maximum_trimmed_length

The maximum_trimmed_length specifies the role of the Length_data_element (see 4.2.422) for the longest finished length of the Length_trimmed_terminal.

4.2.423.2 minimum_trimmed_length

The minimum_trimmed_length specifies the role of the Length_data_element (see 4.2.422) for the shortest finished length of the Length_trimmed_terminal.

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4.2.424 Library_ee_product_definition

A Library_ee_product_definition is a type of Ee_product_definition (see 5.2.4.143) and a type of Library_item (see 5.2.4.52). A Library_ee_product_definition may be a Library_model (see 4.2.426). This provides the ability to store all design data in a library system for archival purposes.

4.2.425 Library_item

A Library_item is a type of Managed_design_object (see 4.2.431). A Library_item is either an Ee_rule (see 5.2.4.51), a Library_ee_product_definition (see 5.2.4.415), or a Part_template (see 4.2.498). A Library_item is an item whose configuration management is a minimal set of information. A Library_item shall not be modified in the design.

The data associated with a Library_item are the following:

— item_name;

— item_version;

— library.

4.2.425.1 item_name

The item_name identifies a Library_item. The item_name need not be specified for a Library_item under certain conditions.

4.2.425.2 item_version

The item_version specifies the identifier for this version of a Library_item. The item_verion need not be specified for a Library_item under certain conditions.

4.2.425.3 library

The library specifies the name of the location of the Library_item in a computer system.

NOTE The configuration management of a library is external to the scope of this part of ISO 10303.

Constraints:

WR1: If the Library_item is a Library_ee_product_definition then item_name and item_version shall not be provided.

WR2: If the Library_item is an Ee_rule or a Part_template then item_name and item_version shall exist.

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4.2.426 Library_model

A Library_model is a type of Analytical_model (see 4.2.10) and Library_ee_product_definition (see 5.2.4.415). The Library_model allows design organizations to control and manage models with the configuration management facilities provided in this Part of 10303 for product defintions. Usually, this occurs in the context of a design library.

NOTE A Library_model provides the ability to manage simulation models using the same configuration management system used for physical products.

4.2.427 Limit_dimension_representation

A Limit_dimension_representation is a type of Shape_dimension_representation (see 4.2.644) that explicitly describes the maximum and minimum limits of one or more Dimensional_characteristic (see 4.2.256).

The data associated with a Limit_dimension_representation are the following:

— lower_dimension_value;

— upper_dimension_value.

4.2.427.1 lower_dimension_value

The lower_dimension_value specifies the Data_element (see 4.2.173) that describes the minimum limit of the Dimensional_characteristic (see 4.2.256) for which the Limit_dimension_representation is a representation.

4.2.427.2 upper_dimension_value

The upper_dimension_value specifies the Data_element (see 4.2.173) that describes the maximum limit of the Dimensional_characteristic (see 4.2.256) for which the Limit_dimension_representation is a representation.

Constraints:

WR1: The value of the upper_dimension_value shall be greater than the value of the lower_dimension_value.

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4.2.428 Line_width_class

A Line_width_class is a type of Managed_design_object (see 4.2.431). A Line_width_class is a category in which a particular group of Conductive_interconnect_element (see 5.2.4.154) may fall, depending on the value of their line width parameter. A Line_width_class shall not specify a curve_font for the Curve_-style (see 5.2.4.253) specified by class_member.

NOTE The Line_width_class is included so that tolerances may be applied to all members of the same class, and specified only once. E.g., all lines with a design width greater than 50 mils and less than 75 mils are in the 'big' class. All members of 'big' shall have a tolerance of +5/-5 mils. Other Application Objects will be populated in order to apply the tolerances to the class.

The data associated with a Line_width_class are the following:

— class_member;

— class_name.

4.2.428.1 class_member

The class_member specifies the role of the Curve_style for the Line_width_class. There shall be one or more Curve_style for the Line_width_class. The Line_width_class uses only the parametric data from Curve_style.

4.2.428.2 class_name

The class_name specifies the name for the Line_width_class.

4.2.429 Linear_extension

A Linear_extension is a type of Derived_shape_element (see 4.2.221) that is derived by linearly extending a Shape_element (see 4.2.645) that is a curve or surface. The Shape_element of which the Linear_extension is an extension is associated with the Linear_extension by the Shape_element_deriving_relationship (see 4.2.649) that are specified as the deriving_relationships.

NOTE The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

Constraints:

WR1: The Linear_extension shall be derived from only one Shape_element.

IP1: The Shape_element from which the Linear_extension is derived shall be a curve or surface.

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4.2.430 Located_interconnect_module_thickness_requirement

A Located_interconnect_module_thickness_requirement is a type of Managed_design_object (see 4.2.431). A Located_interconnect_module_thickness_requirement is a definition that states, at a specific location, that a thickness requirement exists for an Interconnect_module (see 4.2.372).

The data associated with a Located_interconnect_module_thickness_requirement are the following:

— design;

— reference_location;

— maximum_thickness_requirement;

— minimum_thickness_requirement.

4.2.430.1 design

The design is an inverse relationship that specifies that the existence of the Located_interconnect_module_thickness_requirement is dependent on the existence of the Interconnect_module_usage_view (see 4.2.389) that specifies the Located_interconnect_module_thickness_requirement as its overall_thickness_requirement. There shall be one or more Interconnect_module_usage_view for a Located_interconnect_module_thickness_requirement.

NOTE Multiple versions of a product may have the same thickness requirement.

4.2.430.2 reference_location

The reference_location specifies the role of the Axis_placement (see 4.2.43) for the Located_interconnect_module_thickness_requirement.

4.2.430.3 maximum_thickness_requirement

The maximum_thickness_requirement specifies the Length_data_element (see 4.2.422) that is the upper bound for the Located_interconnect_module_thickness_requirement.

4.2.430.4 minimum_thickness_requirement

The minimum_thickness_requirement specifies the Length_data_element (see 4.2.422) that is the lower bound for the Located_interconnect_module_thickness_requirement.

Constraints:

UR1: The combination of the design and the reference_location shall be unique within a population of Located_interconnect_module_thickness_requirements.

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4.2.431 Managed_design_object

A Managed_design_object is one of:

— an Adjacent_stratum_surface_definition (see 4.2.2);

— an Aggregate_connectivity_requirement (see 4.2.4);

— an Alternate_select_product (see 4.2.9);

— an Analytical_model (see 4.2.10);

— an Analytical_model_port (see 4.2.11);

— an Analytical_model_port_assignment (see 4.2.12);

— an Analytical_model_vector_port_assignment (see 4.2.15);

— an Analytical_representation (see 4.2.16);

— an Assembly_bond_definition (see 4.2.26);

— an Assembly_component (see 4.2.27);

— an Assembly_component_2d_shape (see 4.2.28);

— an Assembly_component_3d_shape (see 4.2.29);

— an Assembly_composition_relationship (see 4.2.30);

— an Assembly_joint (see 4.2.32);

— an Assembly_material_composition_relationship (see 4.2.33);

— an Assembly_requirement_allocation (see 4.2.40);

— an Axis_placement (see 4.2.43);

— a Bond_assembly_position (see 4.2.55);

— a Boolean_csg_result (see 4.2.57);

— a Boundary_size_characteristic (see 4.2.60);

— a Bus_element_relationship (see 4.2.64);

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— a Bus_structural_definition (see 4.2.65);

— a Cartesian_coordinate_system (see 4.2.66);

— a Cartesian_point (see 4.2.67);

— a Cartesian_transformation_operator_2d (see 4.2.68);

— a Certification (see 4.2.73);

— a Characteristic (see 4.2.77);

— a Component_2d_location (see 4.2.83);

— a Component_3d_location (see 4.2.84);

— a Component_assembly_2d_position (see 4.2.85);

— a Component_assembly_3d_position (see 4.2.86);

— a Component_feature (see 4.2.90);

— a Component_feature_make_from_relationship (see 4.2.92);

— a Component_feature_relationship (see 4.2.93);

— a Component_feature_to_layout_feature_relationship (see 4.2.94);

— a Component_feature_to_physical_usage_view_assignment (see 4.2.95);

— a Component_group_assignment (see 4.2.96);

— a Component_make_from_relationship (see 4.2.98);

— a Component_mounting_clearance_relationship (see 5.2.4.361);

— a Component_overlap_relationship (see 5.2.4.107);

— a Component_part_2d_geometric_representation_relationship (see 5.2.4.363);

— a Component_part_3d_geometric_representation_relationship (see 5.2.4.414);

— a Component_placement_restriction_assignment (see 5.2.4.374);

— a Component_terminal_to_assembly_module_terminal_assignment (see 5.2.4.18);

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— a Component_terminal_to_interconnect_module_terminal_assignment (see 5.2.4.210);

— a Component_terminal_to_pca_terminal_assignment (see 5.2.4.226);

— a Component_termination_passage_template_terminal (see 4.2.119);

— a Composite_curve_segment (see 5.2.4.379);

— a Composite_signal_property_relationship (see 5.2.4.151);

— a Configuration_controlled_message (see 5.2.4.134);

— a Conical_tolerance_zone_boundary_and_surface_relationship (see 5.2.4.141);

— a Conical_tolerance_zone_boundary_diametrical_size_characteristic (see 5.2.4.346);

— a Connection_zone (see 4.2.147);

— a Connection_zone_model_port_assignment (see 5.2.4.356);

— a Connectivity_allocation (see 5.2.4.165);

— a Connectivity_sub_structure (see 5.2.4.283);

— a Consistent_part_template_shape_projection (see 5.2.4.280);

— a Consistent_physical_unit_shape_projection (see 5.2.4.281);

— a Consistent_stratum_shape_projection (see 5.2.4.409);

— a Contract (see 4.2.159);

— a Coordinated_characteristic (see 5.2.4.383);

— a Csg_primitive (see 4.2.163);

— a Curve_style (see 5.2.4.253);

— a Curve_style_font (see 5.2.4.290);

— a Curve_style_font_and_scaling (see 5.2.4.260);

— a Data_element (see 4.2.173);

— a Date (see 4.2.174);

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— a Datum_axis_and_tolerance_zone_orienting_relationship (see 5.2.4.133);

— a Datum_axis_related_orientation (see 5.2.4.139);

— a Datum_based_direction_vector (see 5.2.4.182);

— a Datum_based_length_measure (see 4.2.181);

— a Datum_based_vector_orientation (see 4.2.182);

— a Datum_feature_material_condition_property (see 5.2.4.368);

— a Datum_feature_usage_in_datum_system_relationship (see 5.2.4.391);

— a Datum_precedence_assignment (see 5.2.4.299);

— a Datum_system_defining_conditions (see 5.2.4.301);

— a Datum_target_usage_in_datum_target_set_relationship (see 5.2.4.67);

— a Datum_usage_in_datum_system_relationship (see 5.2.4.300);

— a Default_assembly_bond_shape (see 4.2.206);

— a Design_composition_path (see 4.2.223);

— a Design_functional_unit_allocation_to_assembly_component (see 5.2.4.187);

— a Design_functional_unit_allocation_to_assembly_joint (see 5.2.4.392);

— a Design_functional_unit_allocation_to_fabrication_joint (see 5.2.4.394);

— a Design_functional_unit_allocation_to_reference_functional_unit (see 5.2.4.400);

— a Design_intent_modification_in_stratum_3d_position (see 5.2.4.48);

— a Design_intent_modification_in_stratum_planar_position (see 5.2.4.223);

— a Design_intent_modification_non_planar_2d_shape (see 5.2.4.191);

— a Design_intent_modification_planar_shape (see 5.2.4.370);

— a Design_intent_modification_sequence (see 5.2.4.44);

— a Design_intent_modification_styled_area_representation (see 5.2.4.24);

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— a Device_2d_position (see 5.2.4.190);

— a Device_3d_position (see 5.2.4.239);

— a Device_terminal_map (see 5.2.4.241);

— a Device_terminal_map_relationship (see 5.2.4.319);

— a Dimension_qualifier (see 5.2.4.183);

— a Dimension_set (see 5.2.4.121);

— a Dimensional_characteristic (see 4.2.256);

— a Dimensional_characteristic_representation (see 5.2.4.56);

— a Direction_element (see 5.2.4.213);

— an Ee_approval (see 4.2.269);

— an Ee_colour (see 5.2.4.353);

— an Ee_document (see 4.2.271);

— an Ee_document_identifier (see 5.2.4.276);

— an Ee_material (see 4.2.273);

— an Ee_product (see 4.2.274);

— an Ee_product_category (see 4.2.275);

— an Ee_product_category_relationship (see 5.2.4.362);

— an Ee_product_configuration (see 5.2.4.395);

— an Ee_product_definition (see 5.2.4.143);

— an Ee_product_model (see 5.2.4.403);

— an Ee_product_specific_parameter_value_assignment (see 5.2.4.416);

— an Ee_product_version (see 4.2.282);

— an Ee_requirement_occurrence (see 4.2.283);

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— an Ee_rule_definition (see 5.2.4.84);

— an Ee_rule_function (see 5.2.4.90);

— an Ee_rule_version (see 5.2.4.234);

— an Ee_text (see 4.2.293);

— an Engineering_make_from (see 4.2.299);

— an Equivalent_functional_terminals_assignment (see 5.2.4.138);

— an Equivalent_functional_unit_definition_assignment (see 5.2.4.142);

— an Evaluated_characteristic (see 5.2.4.158);

— an External_definition (see 4.2.304);

— an Externally_defined_curve_font (see 5.2.4.291);

— an Externally_defined_hatch_style (see 5.2.4.203);

— an Externally_defined_tile (see 5.2.4.204);

— an Externally_defined_tile_style (see 5.2.4.214);

— a Fabrication_joint (see 5.2.4.396);

— a Feature_group_relationship (see 5.2.4.220);

— a Feature_shape_composition_relationship (see 5.2.4.261);

— a Feature_shape_definition (see 4.2.315);

— a Feature_shape_occurrence (see 4.2.316);

— a Fill_area (see 5.2.4.327);

— a Fill_area_occurrence (see 5.2.4.69);

— a Fill_area_style (see 5.2.4.328);

— a Fill_area_style_hatching (see 5.2.4.329);

— a Fill_area_style_tile (see 5.2.4.335);

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— a Fill_area_style_tile_curve_with_style (see 5.2.4.406);

— a Fill_area_style_tile_solid_region (see 5.2.4.405);

— a Fill_area_style_tile_symbol_with_style (see 5.2.4.222);

— a Font_definition (see 5.2.4.341);

— a Frozen_assignment (see 5.2.4.389);

— a Functional_specification (see 5.2.4.104);

— a Functional_specification_to_requirement_occurrence_assignment (see 5.2.4.186);

— a Functional_terminal_group (see 5.2.4.229);

— a Functional_terminal_group_assignment (see 5.2.4.255);

— a Functional_unit (see 5.2.4.313);

— a Functional_unit_network_node_definition (see 4.2.340);

— a Functional_unit_network_terminal_definition_bus_assignment (see 4.2.341);

— a Functional_unit_network_terminal_definition_node_assignment (see 5.2.4.271);

— a Functional_unit_requirement_allocation (see 5.2.4.272);

— a Functional_unit_terminal (see 5.2.4.267);

— a Functional_unit_terminal_bus_assignment (see 5.2.4.304);

— a Functional_unit_terminal_node_assignment (see 5.2.4.337);

— a Functional_unit_usage_view_terminal_definition (see 5.2.4.306);

— a Functional_usage_view_to_part_terminal_assignment (see 5.2.4.342);

— a Functional_usage_view_to_printed_part_template_terminal_assignment (see 5.2.4.343);

— a Geometric_tolerance (see 5.2.4.386);

— a Geometric_tolerance_qualifier (see 5.2.4.74);

— an Inter_stratum_extent (see 5.2.4.83);

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— an Inter_stratum_join_implementation (see 5.2.4.22);

— an Interconnect_module_constraint_region (see 5.2.4.124);

— an Interconnect_module_product_assembly_view_fabrication_joint (see 5.2.4.78);

— an Interconnect_module_component_surface_feature (see 4.2.375);

— an Interconnect_module_edge_segment_surface (see 4.2.380);

— an Interconnect_module_primary_surface (see 5.2.4.146);

— an Interconnect_module_secondary_surface (see 5.2.4.159);

— an Interconnect_module_stratum_assembly_relationship (see 5.2.4.160);

— an Interconnect_module_surface_feature (see 5.2.4.105);

— an Interface_component_allocation (see 5.2.4.199);

— an Interface_mounted_join (see 5.2.4.208);

— an Internal_stratum_access (see 5.2.4.244);

— a Join_relationship (see 5.2.4.34);

— a Junction_vertex_allocation (see 5.2.4.250);

— a Land_template_terminal (see 4.2.413);

— a Layer (see 5.2.4.348);

— a Layer_connection_point (see 5.2.4.420);

— a Layout_spacing_requirement_non_conforming_design_object (see 4.2.419);

— a Library_item (see 5.2.4.52);

— a Line_width_class (see 5.2.4.377);

— a Located_interconnect_module_thickness_requirement (see 5.2.4.189);

— a Marking (see 5.2.4.388);

— a Material_assembly_relationship (see 5.2.5.1);

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— a Material_composition_relationship (see 5.2.5.2);

— a Mating_connector_component (see 5.2.4.200);

— a Mating_connector_placement_relationship (see 5.2.5.3);

— a Mating_connector_termination (see 5.2.5.4);

— a Model_parameter (see 4.2.451);

— a Mounting_restriction_area (see 5.2.4.14);

— a Next_higher_assembly_interface_requirement (see 5.2.4.218);

— an Operational_requirement_occurrence_relationship (see 5.2.5.5);

— an Organization (see 5.2.4.135);

— an Orientation (see 4.2.465);

— an Package_external_reference (see 4.2.471);

— a Package_terminal_external_reference (see 4.2.473);

— a Package_terminal_occurrence (see 4.2.474);

— a Packaged_connector_terminal_relationship (see 4.2.480);

— a Parameter_assignment (see 4.2.487);

— a Part_connected_terminals_definition (see 5.2.4.180);

— a Part_device (see 5.2.4.225);

— a Part_device_terminal (see 5.2.4.259);

— a Part_device_terminal_model_port_assignment (see 5.2.4.366);

— a Part_feature_model_port_assignment (see 5.2.4.164);

— a Part_template_3d_shape (see 5.2.4.108);

— a Part_template_non_planar_2d_shape (see 5.2.4.375);

— a Part_template_planar_shape (see 5.2.4.314);

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— a Participant_date_and_time_assignment (see 4.2.508);

— a Passage_technology (see 4.2.509);

— a Person (see 5.2.4.251);

— a Person_and_organization (see 5.2.4.275);

— a Physical_connectivity_abstraction_map (see 4.2.520);

— a Physical_connectivity_definition (see 5.2.4.1);

— a Physical_connectivity_definition_relationship (see 4.2.522);

— a Physical_connectivity_element (see 4.2.523);

— a Physical_connectivity_make_from_relationship (see 4.2.525);

— a Physical_network (see 5.2.4.17);

— a Physical_node_requirement_to_implementing_component_allocation (see 5.2.4.209);

— a Physical_unit_3d_shape (see 4.2.534);

— a Physical_unit_planar_shape (see 4.2.536);

— a Physical_unit_relationship (see 4.2.537);

— a Placement_group (see 4.2.539);

— a Placement_group_area_assignment (see 5.2.4.320);

— a Planned_characteristic (see 5.2.4.181);

— a Planned_effectivity (see 4.2.545);

— a Positional_boundary_and_profile_boundary_member_relationship (see 4.2.562);

— a Positional_boundary_definition (see 5.2.4.323);

— a Positional_boundary_member_definition (see 5.2.4.324);

— a Positional_boundary_offset (see 4.2.566);

— a Positive_ratio_measure (see 4.2.567);

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— a Printed_connector_template_terminal_relationship (see 4.2.578);

— a Printed_part_template_connected_terminals_definition (see 4.2.582);

— a Printed_part_template_material (see 4.2.585);

— a Printed_part_template_terminal (see 4.2.586);

— a Printed_part_template_terminal_relationship (see 4.2.587);

— a Product_association (see 4.2.590);

— a Projected_zone_and_base_relationship (see 4.2.602);

— a Projected_zone_height_characteristic (see 4.2.603);

— a Promissory_usage_relationship (see 4.2.604);

— a Reference_composition_path (see 5.2.4.402);

— a Reference_functional_unit_assignment_to_part (see 4.2.609);

— a Registered_font (see 4.2.610);

— a Registered_style (see 4.2.611);

— a Representation (see 4.2.612);

— a Requirement_allocation (see 4.2.613);

— a Requirement_composition (see 5.2.4.49);

— a Restraint_condition (see 5.2.4.192);

— a Rule_action (see 5.2.4.92);

— a Rule_justification (see 4.2.627);

— a Rule_priority (see 4.2.629);

— a Rule_set (see 4.2.632);

— a Runout_tolerance_zone_orienting_relationship (see 4.2.637);

— a Runout_zone_orientation (see 4.2.638);

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— a Security_classification (see 4.2.642);

— a Separate_geometric_tolerance_requirement (see 4.2.643);

— a Shape_dimension_representation (see 4.2.644);

— a Shape_element (see 4.2.645);

— a Shape_element_locating_relationship (see 4.2.650);

— a Shape_element_relationship (see 5.2.4.169);

— a Signal (see 5.2.4.198);

— a Signal_property (see 5.2.4.150);

— a Signal_specification (see 5.2.4.122);

— a Simultaneous_geometric_tolerance_requirement (see 4.2.660);

— a Solid_curve (see 5.2.4.286);

— a Solid_fill_style (see 5.2.4.345);

— a Specification_allocation (see 4.2.669);

— a Stratum (see 4.2.677);

— a Stratum_3d_shape (see 5.2.4.410);

— a Stratum_average_surface (see 4.2.679);

— a Stratum_average_surface_shape (see 5.2.4.380);

— a Stratum_concept_relationship (see 5.2.4.359);

— a Stratum_concept_to_physical_usage_view_assignment (see 5.2.4.136);

— a Stratum_feature_3d_shape (see 4.2.684);

— a Stratum_feature_in_stratum_3d_position (see 4.2.686);

— a Stratum_feature_in_stratum_planar_position (see 4.2.687);

— a Stratum_feature_non_planar_2d_shape (see 4.2.688);

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— a Stratum_feature_shape_stratum_average_surface_shape_relationship (see 5.2.4.309);

— a Stratum_feature_shape_stratum_surface_shape_relationship (see 5.2.4.308);

— a Stratum_feature_styled_area_representation (see 5.2.4.373);

— a Stratum_interconnect_module_3d_position (see 5.2.4.170);

— a Stratum_interconnect_module_planar_position (see 5.2.4.178);

— a Stratum_make_from_relationship (see 4.2.697);

— a Stratum_planar_shape (see 5.2.4.206);

— a Stratum_surface (see 4.2.699);

— a Stratum_surface_in_stratum_3d_position (see 4.2.700);

— a Stratum_surface_shape (see 5.2.4.115);

— a Stratum_technology (see 4.2.702);

— a Stratum_technology_line_width_tolerance_assignment (see 4.2.703);

— a Structured_text (see 5.2.4.330);

— a Styled_curve_occurrence (see 5.2.4.81);

— a Sub_assembly_relationship (see 4.2.707);

— a Substitute_product (see 4.2.708);

— a Supplied_product_version (see 4.2.709);

— a Technology (see 4.2.716);

— a Terminal_pair_port_equivalence_relationship (see 4.2.717);

— a Termination_constraint (see 4.2.719);

— a Thermal_isolation_requirement_assignment (see 4.2.726);

— a Tolerance_zone_and_viewing_plane_orienting_relationship (see 4.2.733);

— a Tolerance_zone_boundary_definition (see 4.2.735);

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— a Tolerance_zone_boundary_member_offset (see 4.2.737);

— a Tolerance_zone_definition (see 4.2.739);

— a Tolerance_zone_form (see 4.2.743);

— a Tolerance_zone_per_unit_size_specification (see 4.2.746);

— a Topological_junction (see 5.2.4.205);

— a Transmission_line_functional_unit_terminal_allocation (see 4.2.750);

— a True_profile (see 4.2.753);

— an Usage_concept_usage_relationship (see 4.2.757);

— a Vector (see 5.2.4.393);

— a Via_template_terminal (see 4.2.767);

— a Viewing_plane_based_orientation (see 4.2.770);

— a Viewing_plane_definition (see 4.2.771);

— a Volume_shape_projection (see 4.2.772);

— a Work_order (see 4.2.774);

— a Work_request (see 4.2.775).

Additionally, a Managed_design_object may be a Frozen_design_object (see 5.2.4.23). A Managed_-design_object is the explicit subject of a change specification.

4.2.432 Marking

A Marking is a type of Managed_design_object (see 4.2.431). A Marking is the specification of what, where, and how information that is placed on a Physical_unit (see 4.2.533) for identification purposes is applied. Marking in this part of ISO 10303 is considered to not be part of the definition of a Stratum (see 4.2.677). Marking is text that is applied to a material object.

EXAMPLE 1 Laminate_text_component is text that is realized through the manufacturing process. Reference designators that are created on the board during etching are members of Laminate_text_component.

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The data associated with a Marking are the following:

— marked_device;

— marked_message;

— marking_material;

— marking_specification;

— message_representation;

— placement.

4.2.432.1 marked_device

The marked_device specifies either an Assembly_module (see 4.2.34), an Interconnect_module (see 4.2.372), a Packaged_part (see 4.2.481), a Pca (see 4.2.510), or a Pcb (see 5.2.4.38) that receives the Marking.

4.2.432.2 marked_message

The marked_message specifies either a Configuration_controlled_message (see 5.2.4.134) or Structured_-text (see 5.2.4.330) for Marking.

4.2.432.3 marking_material

The marking_material specifies the Ee_material (see 4.2.273) used in the Marking.

4.2.432.4 marking_specification

The marking_specification specifies the Ee_specification (see 4.2.292) of the process and format for properly applying the Marking.

4.2.432.5 message_representation

The message_representation specifies role of the Styled_text (see 5.2.4.270) for the Marking.

4.2.432.6 placement

The placement specifies the Axis_placement (see 4.2.43) of the Marking.

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4.2.433 Material_addition_feature

A Material_addition_feature is a type of Design_intent_modification (see 5.2.4.408) that describes the material that is to be added in the realization of the feature specified by the design_intent attribute inherited from Design_intent_modification. This requirement shall be interpreted as being mathematically equivalent to the application of the regularized Boolean geometric OR operation where the design_intent is OR'd with the shape of the Material_addition_feature.

4.2.434 Material_addition_feature_template

A Material_addition_feature_template is a type of Part_template (see 4.2.498) that describes the shape of material to be added to a design feature.

4.2.435 Material_assembly_relationship

A Material_assembly_relationship is a type of Managed_design_object (see 4.2.431). A Material_assembly_relationship is an association between one Ee_material (see 4.2.273) in the role of assembly and another Ee_material in the role of component. A Material_assembly_relationship allows the assembly of materials to create a physical object. Material_assembly_relationship is used when tight tolerances on material quantity or geometrical accuracy is not required.

The data associated with a Material_assembly_relationship are the following:

— assembly;

— component;

— component_identifier.

4.2.435.1 assembly

The assembly specifies the Ee_material (see 4.2.273) to which the component Ee_material is assembled for the Material_assembly_relationship.

4.2.435.2 component

The component specifies the Ee_material (see 4.2.273) that is added to the assembly Ee_material for the Material_assembly_relationship.

4.2.435.3 component_identifier

The component_identifier specifies the string that identifies the component in the assembly.

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Constraints:

UR1: The combination of the assembly and the component_identifier shall be unique within a population of Material_assembly_relationships.

WR1: Material shall not be an ancestor or descendent of itself when the set of Material_assembly_relationships are represented with a graph.

NOTE Mixtures or chemical compounds are not intended to be represented by this relationship.

4.2.436 Material_composition_relationship

A Material_composition_relationship is a type of Managed_design_object (see 4.2.431). A Material_composition_relationship is the association between one Ee_material (see 4.2.273) and another when describing a composite material.

The data associated with a Material_composition_relationship are the following:

— composition_basis;

— composition_class;

— constituent_amount;

— determination_method;

— related_product;

— relating_product.

4.2.436.1 composition_basis

The composition_basis specifies the string that represents the basis on which a material product is decomposed into its constituents.

4.2.436.2 composition_class

The composition_class specifies the string that represents the category of composition for the Material_composition_relationship.

4.2.436.3 constituent_amount

The constituent_amount specifies the Data_element (see 4.2.173) that represents the amount of material.

4.2.436.4 determination_method

The determination_method specifies the string that represents the procedure by which constituent_amount is determined.

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4.2.436.5 related_product

The related_product is Ee_material (see 4.2.273) that is the constituent for the Material_composition_-relationship. There shall be one or more Ee_material for the Material_composition_relationship.

4.2.436.6 relating_product

The relating_product is Ee_material (see 4.2.273) that is the composition for which this Material_composition_relationship is specifying a constituent.

NOTE This relationship is intended for compounds and simple mixtures only, not for assemblies.

4.2.437 Material_electrical_conductivity_requirement_occurrence

A Material_electrical_conductivity_requirement_occurrence is a type of Electrical_requirement_occurrence (see 5.2.4.3) that specifies the requirement for conductive material.

The data associated with a Material_electrical_conductivity_requirement_occurrence are the following:

— electrical_conductivity_characteristic.

4.2.437.1 electrical_conductivity_characteristic

The electrical_conductivity_characteristic specifies either a conductive, a non_conductive, a resistive, or a semi_conductive classification of material conductivity for the Material_electrical_conductivity_-classification.

NOTE These are generic category names. If more specific data is required, the characteristics should be associated to the Material_electrical_conductivity_requirement_occurrence using the required_coordinated_characteristic or the required_characteristic inherited from Ee_requirement_occurrence.

4.2.438 Material_removal_feature

A Material_removal_feature is a type of Design_intent_modification (see 5.2.4.408) that indicates that material is to be removed in the realization of the feature that is in the role of design_intent inherited from Design_intent_modification. A Material_removal_feature may be a Filled_area_material_removal_structure (see 5.2.4.101). The requirement shall be interpreted mathematically as a requirement for application of the regularized Boolean subtraction operation.

The data associated with a Material_removal_feature are the following:

— material_removal_shape.

4.2.438.1 material_removal_shape

The material_removal_shape specifies the role of the Material_removal_feature_template (see 4.2.439) for the Material_removal_feature.

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4.2.439 Material_removal_feature_template

A Material_removal_feature_template is a type of Part_template (see 4.2.498) that describes the shape of material to be removed from a feature. The purposes predefined in this part of ISO 10303 include electrical and thermal isolation.

EXAMPLE 1 Figure 59 illustrates a template and associated parameters designed for electrical isolation. For a specific template, values will be assigned for the parameters and the explicit geometry will be representative of the assigned parameter values.

EXAMPLE 2 Figure 60 illustrates a template and associated parameters designed for thermal isolation. For a specific template, values will be assigned for the parameters and the explicit geometry will be representative of the assigned parameter values. In this example, an instance would be a complex instance including Composite_unit_shape_element (see 5.2.4.63) and Material_removal_feature_template.

4.2.440 Material_shape_modification

A Material_shape_modification is a type of Design_intent_modification (see 5.2.4.408) that indicates that the shape of material of the feature in the role of design_intent inherited from Design_intent_modification is to be modified to suit the design intent. The mathematical interpretation shall be dependent on the operator instance data in the geometrical representation used in the model. A Material_shape_modification shall be represented only by a geometric representation capable of supporting regularized Boolean operations.

4.2.441 Material_specification

A Material_specification is a type of Ee_specification (see 4.2.292) that specifies properties applicable to raw material, mixtures, or semi-fabricated material that are used in the fabrication of a product. A Material_specification may be a Surface_finish_specification (see 4.2.710).

EXAMPLE 1 An example of a semi-fabricated material is the partially cured adhesive sheets which often are composed of a glass fiber mat and "B-stage" epoxy. Semi-fabricated material may be purchased or sold by an enterprise, in the same way that raw materials or mixtures may.

4.2.442 Mating_connector_component

A Mating_connector_component is a type of Managed_design_object (see 4.2.431). A Mating_connector_component is the connector on the next higher assembly with which a connector on the assembly must mate. A Mating_connector_component may be specified in the role of mating_requirement by an Interface_component_allocation (see 5.2.4.199).

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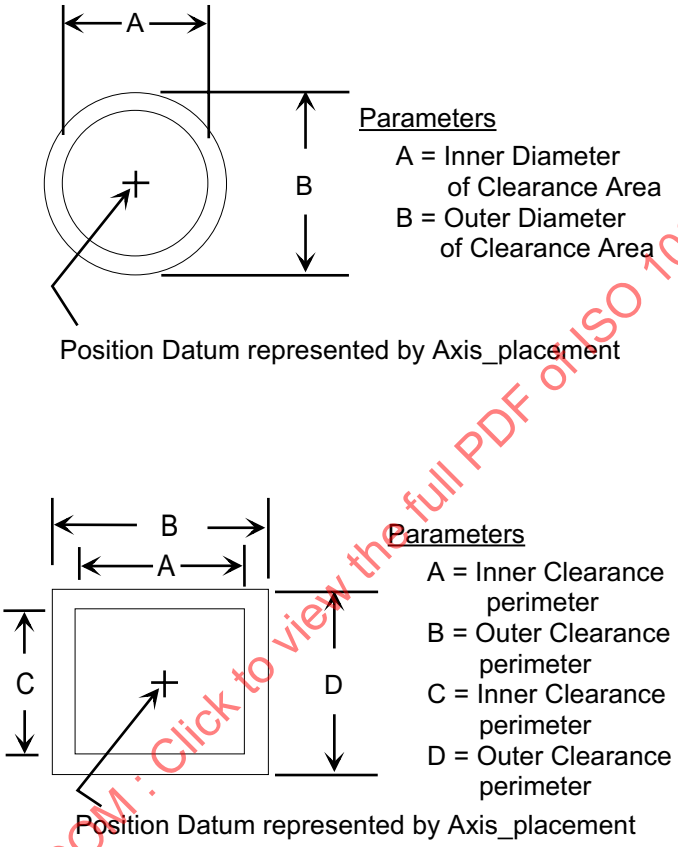

Physical characteristics are inherited from Part_template.

Reference_document is : IEC 61182-1

Note : Electrical Isolation

Figure 59 – Material_removal_feature_template supports electrical isolation

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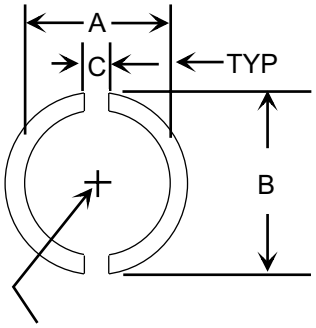
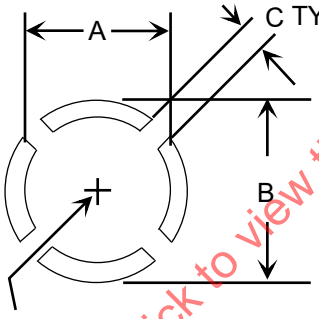


Parameters

A = Inner diameter of clearance area
B = Outer Diameter of clearance area
C = Rib Width

Position Datum represented by Axis_placement



Parameters

A = Inner diameter of clearance area
B = Outer Diameter of clearance area
C = Rib Width

Position Datum represented by Axis_placement

Physical characteristics are inherited from Part_template.

Reference_document is : IEC 61182-1

Note : Thermal isolation

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Figure 60 – Material_removal_feature_template supports thermal isolation and electrical conduction

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The data associated with a Mating_connector_component are the following:

— definition;

— placement_context;

— reference_designation.

4.2.442.1 definition

The definition specifies the role of either an Ee_specification (see 4.2.292), a Packaged_connector (see 4.2.477), or a Printed_connector_template (see 4.2.577) for the Mating_connector_component.

4.2.442.2 placement_context

The placement_context is an inverse relationship that specifies that the existence of the Mating_connector_component is dependent on the existence of the Mating_connector_placement_relationship (see 5.2.5.3) that specifies the Mating_connector_component as its placed_connector.

4.2.442.3 reference_designation

The reference_designation specifies the name that serves as the identifier of the location of the Mating_connector_component in the next level of assembly. The reference_designation need not be specified for a particular Mating_connector_component.

4.2.443 Mating_connector_placement_relationship

A Mating_connector_placement_relationship is a type of Managed_design_object (see 4.2.431). A Mating_connector_placement_relationship is the association between the connector that the interface connector on the assembly must mate with in the next higher assembly, and the resultant placement of that mating connector in the assembly being designed for test and evaluation. The evaluation may include fit checks and evaluation of other material properties. The application of Mating_connector_placement_relationship is limited to three-dimensional geometric systems.

The data associated with a Mating_connector_placement_relationship are the following:

— connector_placement;

— interface_context;

— placed_connector.

4.2.443.1 connector_placement

The connector_placement specifies the role of the Axis_placement (see 4.2.43) for the Mating_connector_placement_relationship. The Axis_placement shall be an Axis2_placement_3d.

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4.2.443.2 interface_context

The interface_context specifies the role of the Next_higher_assembly_interface_requirement (see 5.2.4.218) for the Mating_connector_placement_relationship. The coordinated system of the shape representing the Next_higher_assembly_interface_requirement shall be congruent with the coordinate system of the assembly being designed.

4.2.443.3 placed_connector

The placed_connector specifies the role of the Mating_connector_component (see 5.2.4.200) for the Mating_connector_placement_relationship.

4.2.444 Mating_connector_termination

A Mating_connector_termination is a type of Managed_design_object (see 4.2.431). A Mating_connector_termination is a single terminal of a Mating_connector_component.

The data associated with a Mating_connector_termination are the following:

— accessed_connector;

— definition;

— name;

— signal_definition.

4.2.444.1 accessed_connector

The accessed_connector specifies the role of the Mating_connector_component (see 5.2.4.200) for the Mating_connector_termination.

4.2.444.2 definition

The definition specifies either a Packaged_part_terminal (see 5.2.4.310) or a Printed_part_template_terminal (see 4.2.586) for the Mating_connector_termination.

4.2.444.3 name

The name specifies the identifier for the Mating_connector_termination.

4.2.444.4 signal_definition

The signal_definition specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Mating_connector_termination. The signal_definition need not be specified for a particular Mating_connector_termination.

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Constraints:

UR1: The combination of the accessed_connector and the definition shall be unique within a population of Mating_connector_termination.

4.2.445 Maximum_dimension_representation

A Maximum_dimension_representation is a type of Singular_dimension_representation (see 4.2.663) that explicitly describes the maximum limit of one or more Dimensional_characteristic (see 4.2.256) and in which the minimum limit is not specified as it is determined by other elements of the design.

NOTE Maximum dimensions are discussed in 4.4 of ISO 406.

4.2.446 Maximum_tolerance_characteristic

A Maximum_tolerance_characteristic is a type of Tolerance_characteristic (see 5.2.4.168). The Maximum_tolerance_characteristic indicates the maximum allowed value for the parameter specified.

The data associated with a Maximum_tolerance_characteristic are the following:

— component_characteristic.

4.2.446.1 component_characteristic

The component_characteristic specifies the maximum value of the Numeric_parameter (see 4.2.460) for the Maximum_tolerance_characteristic.

4.2.447 Minimally_defined_bare_die_terminal

A Minimally_defined_bare_die_terminal is a type of Part_terminal (see 4.2.502). A Minimally_defined_bare_die_terminal may be either a Guided_wave_bare_die_terminal (see 5.2.4.411) or a Bare_die_terminal (see 4.2.50). The associated_definition specifies the Bare_die (see 4.2.47) to which the Bare_die_terminal provides electrical access. A Minimally_defined_bare_die_terminal does not include location or shape information

4.2.448 Minimally_defined_component_terminal

A Minimally_defined_component_terminal is a type of Component_terminal (see 4.2.105) that is included to permit references to terminals without including geometric representations of the terminals.

The data associated with a Minimally_defined_component_terminal are the following:

— definition.

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4.2.448.1 definition

The definition specifies the role of the Part_terminal_external_reference (see 4.2.503) for the Minimally_defined_component_terminal.

4.2.449 Minimum_dimension_representation

A Minimum_dimension_representation is a type of Singular_dimension_representation (see 4.2.663) that explicitly describes the minimum limit of one or more Dimensional_characteristic (see 4.2.256) and in which the maximum limit is not specified as it is determined by other elements of the design.

NOTE Minimum dimensions are discussed in 4.4 of ISO 406.

4.2.450 Minimum_tolerance_characteristic

A Minimum_tolerance_characteristic is a type of Tolerance_characteristic (see 5.2.4.168). The Minimum_tolerance_characteristic indicates the minimum allowed value for the parameter specified.

The data associated with a Minimum_tolerance_characteristic are the following:

— component_characteristic.

4.2.450.1 component_characteristic

The component_characteristic specifies the minimum value of the Numeric_parameter (see 4.2.460) for the Minimum_tolerance_characteristic.

4.2.451 Model_parameter

A Model_parameter is a type of Managed_design_object (see 4.2.431). A Model_parameter is a formally declared variable of the Analytical_model (see 4.2.10) provided for an external application to populate at execution time in a computing environment.

EXAMPLE 1 In Spice, temperature is a Model_parameter that may be set at the execution time.

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The data associated with a Model_parameter are the following:

— default_value;

— parameter_type;

— reference_document;

— type_name;

— unit_of_measure;

— valid_range.

4.2.451.1 default_value

The default_value specifies either a Characteristic (see 4.2.77) or a Coordinated_characteristic (see 5.2.4.383) for the parameter. The default_value need not be specified for a particular Model_parameter. When a collection of data types needs to be defined, so that an instance of the collection may be referenced, the Coordinated_characteristic is used. The External_definition (see 4.2.304) specifies the reference_document to define the semantics of the collection.

4.2.451.2 parameter_type

The parameter_type specifies either a boolean_property_type, a logical_property_type, a physical_property_type, or a string_property_type for the Model_parameter.

4.2.451.3 reference_document

The reference_document specifies either an Ee_document (see 4.2.271) or an identifier for the standard document that contains the reference for the Model_parameter. The reference_document shall define the mapping between the parameter_type string values and the semantics to be applied by a simulator, except for the case of physical_property_type which is predefined in this part of ISO 10303.

4.2.451.4 type_name

The type_name specifies the string used as the human-interpretable type name for the Model_parameter.

4.2.451.5 unit_of_measure

The unit_of_measure specifies the string used as the descriptive label for the unit of measure associated with the Model_parameter. The unit_of_measure need not be specified for a particular Model_parameter. The representation of units described in ISO 10303-41 shall be used.

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4.2.451.6 valid_range

The valid_range specifies the Coordinated_characteristic (see 5.2.4.383) of the Model_parameter. The valid_range need not be specified for a particular Model_parameter. There may be more than one Coordinated_characteristic for a Model_parameter. The valid_ranges need not be contiguous.

NOTE The base units of the valid_range and default_value are the same type.

Constraints:

UR1: The combination of the reference_document and the type_name shall be unique within a population of Model_parameter.

4.2.452 Mounting_restriction_area

A Mounting_restriction_area is a type of Managed_design_object (see 4.2.431). A Mounting_restriction_area is the region on an Interconnect_module_component (see 4.2.373) where mounting restrictions for components exist. The shape representing the Mounting_restriction_region shall have an origin that is congruent with the origin of the shape representing the Interconnect_module_component. This congruency shall be accomplished using concepts equivalent to the Application objects Component_2d_position or Component_3d_position. The shape representing the Mounting_restriction_area is itself in the shape of the assembly, as is the shape of the Interconnect_module_component. The congruency requirement is established so that an application interface can more unambiguously import the Mounting_restriction_area into a CAD layout tool. Mounting_restriction_area is part of a design requirement for an interconnect that is established in the assembly or assemblies in which the interconnect is used. The interconnect shall specify the assembly or assemblies it is designed to support by the assembly_design_requirement attribute of Interconnect_module (see 4.2.372) if the attribute is present.

The data associated with a Mounting_restriction_area are the following:

— area;

— mounting_surface;

— scope.

4.2.452.1 area

The area specifies the role of the Feature_shape_occurrence (see 4.2.316) as describing the shape of the Mounting_restriction_area.

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4.2.452.2 mounting_surface

The mounting_surface specifies the role of the Interconnect_module_component_surface_feature (see 4.2.375) for the Mounting_restriction_area. There shall be one surface in the role of mounting_surface for a Mounting_restriction_area. The type of surface is determined by the definition of the Interconnect_module_component_surface_feature specified by mounting_surface. The mounting_surface conveys design intent to identify the component that implements the connectivity prescribed by the relevant member of Physical_connectivity_definition (see 5.2.4.1).

4.2.452.3 scope

The scope specifies the role of the Interconnect_module_component (see 4.2.373) for the Mounting_restriction_area.

Constraints:

WR1: The mounting_surface shall be in the scope.

4.2.453 Next_higher_assembly_interface_requirement

A Next_higher_assembly_interface_requirement is a type of Managed_design_object (see 4.2.431). A Next_higher_assembly_interface_requirement is the association between the version of the next higher assembly and a shape that simulates the fit characteristics of the next higher assembly. The coordinate system of the shape is congruent with the coordinate system of the current design. The shape simulates a maximum material condition state of the next higher assembly.

The data associated with a Next_higher_assembly_interface_requirement are the following:

— shape;

— version_of_next_higher_assembly.

4.2.453.1 shape

The shape specifies the Bound_volume_shape (see 4.2.58) for the model for the Next_higher_assembly_interface_requirement.

4.2.453.2 version_of_next_higher_assembly

The version_of_next_higher_assembly specifies the Ee_product_version (see 4.2.282) of the Next_higher_assembly_interface_requirement.

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4.2.454 Next_higher_assembly_relationship

A Next_higher_assembly_relationship is a type of Assembly_composition_relationship (see 4.2.30). A Next_higher_assembly_relationship is the association of a component to the assembly it helps to compose.

EXAMPLE 1 Figure 61 illustrates roles of several components in the related assembly.

The data associated with a Next_higher_assembly_relationship are the following:

— assembly_position_2d;

— assembly_position_3d;

— quantity;

— reference_designation.

4.2.454.1 assembly_position_2d

The assembly_position_2d is an inverse relationship that specifies the Component_assembly_2d_position (see 4.2.85) that specifies the Next_higher_assembly_relationship as its component. There shall be no more than one Component_assembly_2d_position for a Next_higher_assembly_relationship.

4.2.454.2 assembly_position_3d

The assembly_position_3d is an inverse relationship that specifies the Component_assembly_3d_position (see 4.2.86) that specifies the Next_higher_assembly_relationship as its component. There shall be no more than one Component_assembly_3d_position for a Next_higher_assembly_relationship.

4.2.454.3 quantity

The quantity specifies the role of the Data_element (see 4.2.173) for the Next_higher_assembly_relationship. The quantity need not be specified for a particular Next_higher_assembly_relationship.

4.2.454.4 reference_designation

The reference_designation specifies the ee_name as an identifier for the Next_higher_assembly_relationship.

NOTE Some components, such as mechanical fasteners, may not be identified by reference_designations within a PCA. They are tracked in the Bill of Material for the PCA by part number and quantity. This application practice varies among enterprises. This practice is supported by Assembly_composition_relationship and not by Next_higher_assembly_relationship.

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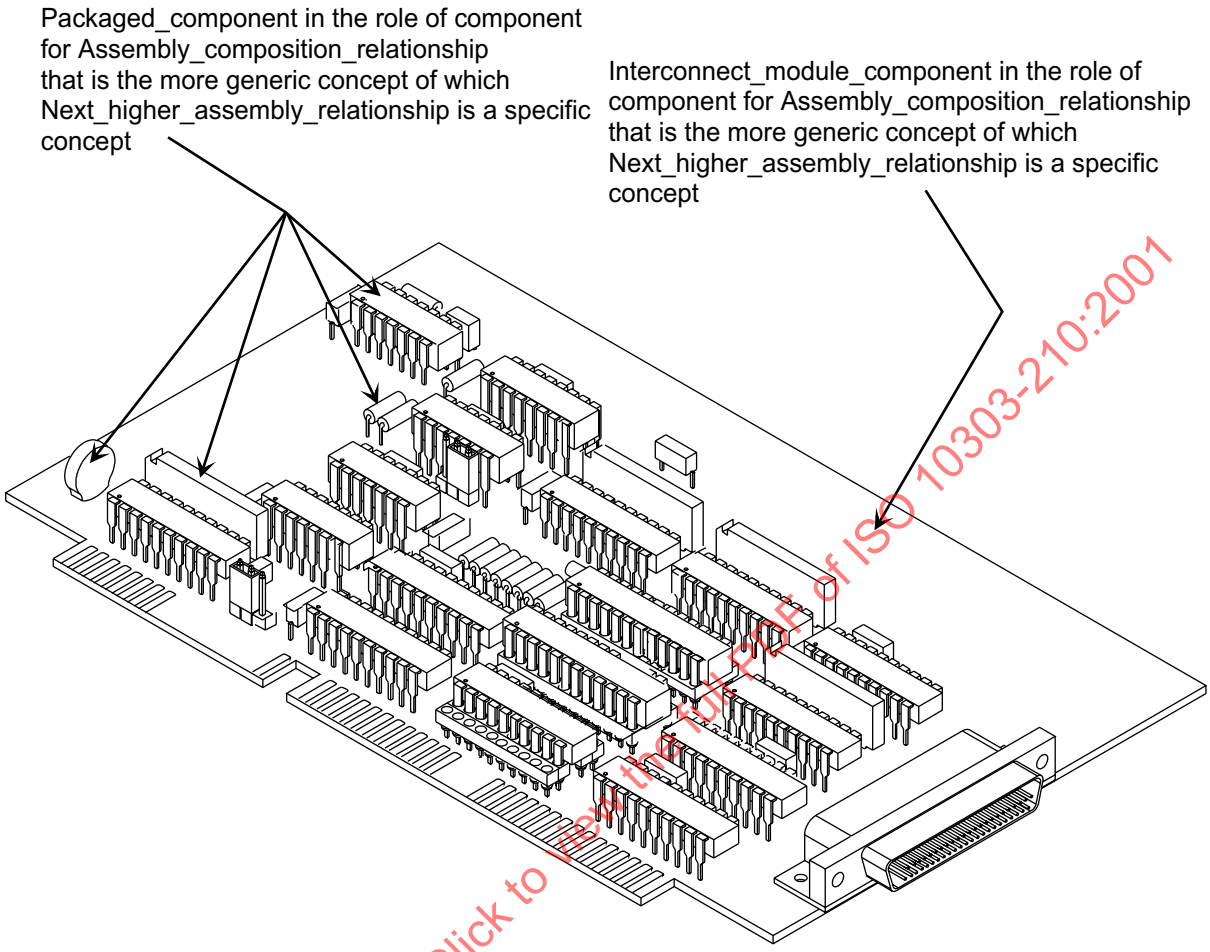

Figure 61 – Next_higher_assembly_relationship

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Constraints:

UR1: The combination of reference_designation and the assembly attribute inherited from the supertype Assembly_composition_relationship shall be unique within a population of Next_higher_assembly_-relationship.

IP1: The quantity shall be provided only when the related Assembly_component is an Interconnect_-component, and the quantity shall be a length unit.

IP2: Things shall not be located on themselves.

4.2.455 Non_conductive_base_blind_via

A Non_conductive_base_blind_via is a type of Blind_via (see 4.2.53) with a floor whose material is non-conductive.

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4.2.456 Non_feature_shape_element

A Non_feature_shape_element is a type of Shape_element (see 4.2.645) that is not on the physical boundary of a Physical_unit (see 4.2.533). A Non_feature_shape_element may be one of a Datum_reference_frame (see 5.2.4.302), a Datum_system (see 5.2.4.316), a Derived_shape_element (see 4.2.221), a Directed_axis (see 5.2.4.61), a Positional_boundary (see 4.2.561), a Positional_boundary_member (see 5.2.4.321), a Tolerance_zone (see 4.2.732), a Tolerance_zone_boundary (see 4.2.734), a Tolerance_zone_boundary_member (see 4.2.736), or a Viewing_plane (see 4.2.769). Additionally, a Non_feature_shape_element may be a Datum (see 4.2.176).

EXAMPLE 1 The centre axis of a cylindrical hole is a Non_feature_shape_element.

Constraints:

WR1: If the Non_feature_shape_element is a Datum it shall not also be a Datum_reference_frame, a Datum_system, a Directed_axis, a Positional_boundary, a Positional_boundary_member, a Tolerance_zone, a Tolerance_zone_boundary, a Tolerance_zone_boundary_member, or a Viewing_plane.

IP1: The Non_feature_shape_element shall not be on the boundary of a Physical_unit.

4.2.457 Non_functional_land

A Non_functional_land is a type of Stratum_feature_template_component (see 5.2.4.161) whose implementing Stratum_feature (see 4.2.683) is not also being composed by other instances of Laminate_component (see 4.2.404). A Non_functional_land may be one of a Component_termination_passage_and_contact_size_dependent_non_functional_land (see 5.2.4.273), a Component_termination_passage_dependent_non_functional_land (see 5.2.4.167), a Contact_size_dependent_non_functional_land (see 5.2.4.119), an Unsupported_passage_dependent_non_functional_land (see 4.2.755), a Via_and_contact_size_dependent_non_functional_land (see 4.2.763), or a Via_dependent_non_functional_land (see 4.2.765). A Non_functional_land is defined in IEC 60050-541.

The data associated with a Non_functional_land are the following:

— access_mechanism;

— alternate_land_definition;

— interface_access_mechanism;

— usage_definition.

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4.2.457.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Non_functional_land is dependent on the existence of the Non_functional_land_join_terminal (see 5.2.4.13) that specifies the Non_functional_land as its associated_component. There shall be one or more Non_functional_land_join_terminal for a Non_functional_land. The access_mechanism is only provided for support of plated passages within the lateral geometric boundary of the Non_functional_land and.

4.2.457.2 alternate_land_definition

The alternate_land_definition specifies one role of the Land_physical_template (see 5.2.4.85) for the Non_functional_land. The alternate_land_definition need not be specified for a particular Non_functional_land. An alternate_land_definition overrides the usage_definition if it is provided.

4.2.457.3 interface_access_mechanism

The interface_access_mechanism is an inverse relationship that specifies that the existence of the Non_functional_land is dependent on the existence of the Non_functional_land_interface_terminal (see 4.2.458) that specifies the Non_functional_land as its associated_component.

4.2.457.4 usage_definition

The usage_definition specifies one role of the Land_physical_template (see 5.2.4.85) for the Non_functional_land.

Constraints:

WR1: There shall be no direct connection to a Conductive_interconnect_element from a member of Non_functional_land.

WR2: The stratum_feature specified by SELF\stratum_feature_template_component.stratum_feature_implementation shall not be in the role of stratum_feature_implementation for any other stratum_feature_template_component.

4.2.458 Non_functional_land_interface_terminal

A Non_functional_land_interface_terminal is a type of Component_feature (see 4.2.90) included to identify the interface available for attachment in the next level of assembly.

NOTE Use of this capability occurs when a member of Component_feature_to_physical_usage_view_assignment (see 4.2.95) references a member of Non_functional_land_interface_terminal to assign a relationship to an Interconnect_module_terminal (see 5.2.4.211).

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The data associated with a Non_functional_land_interface_terminal are the following:

— associated_component;

— definition.

4.2.458.1 associated_component

The associated_component specifies the role of the Non_functional_land (see 5.2.4.274) for the Non_-functional_land_interface_terminal.

4.2.458.2 definition

The definition specifies the role of the Land_template_interface_terminal (see 5.2.4.307) for the Non_-functional_land_interface_terminal.

Constraints:

WR1: The Land_template that is the usage_definition for the Non_functional_land in the role of associated_component for this Non_functional_land_interface_terminal is the associated_definition for the definition of this Non_functional_land_interface_terminal.

4.2.459 Non_functional_land_join_terminal

A Non_functional_land_join_terminal is a type of Component_terminal (see 4.2.105) that is included in a design to support the description of the relationship between the Non_functional_land and a plated passage that implements a connection to a feature on a different member of Stratum (see 4.2.677) than the member of Stratum the Non_functional_land_join_terminal is associated with.

The data associated with a Non_functional_land_join_terminal are the following:

— associated_component;

— definition.

4.2.459.1 associated_component

The associated_component specifies the role of the Non_functional_land (see 5.2.4.274) for the Non_-functional_land_join_terminal.

4.2.459.2 definition

The definition specifies the role of the Land_template_join_terminal (see 5.2.4.311) for the Non_functional_land_join_terminal. The valid purposes for a Non-functional_land_join_terminal are to connect to a Via_terminal or a Component_termination_passage_join_terminal.

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Constraints:

WR1: The Land_template that is the usage_definition for the Non_functional_land this Non_functional_land_join_terminal is a terminal of is the associated_definition for the definition of this Non_-functional_land_join_terminal.

WR2: A Non_functional_land_join_terminal is only to be connected to a passage join terminal, and to nothing else. It is not allowed to be connected to a trace on the same layer; the join is required to be to a passage within the lateral extent of the non-functional land.

4.2.460 Numeric_parameter

A Numeric_parameter is a type of Characteristic (see 4.2.77). A Numeric_parameter is a quantitative value in an identified unit of measure. Uncertainty may be applied to the value by referencing the Qualified_data_element (see 4.2.606) type of Data_element.

NOTE Actual values of occurrence data will be dependent on many variables.

The data associated with a Numeric_parameter are the following:

— property_value.

4.2.460.1 property_value

The property_value specifies the Data_element (see 4.2.173) for the quantitative value and unit of measure for the Numeric_parameter.

4.2.461 Open_shell_based_surface

A Open_shell_based_surface is a type of Feature_shape_definition (see 4.2.315) that represents a shape with a simple or complex surface using a set of connected faces. The shape shall be manifold and shall not be closed. The shape shall not be used in the composition of a closed volume. The shape shall be a single shell if it is the shape of a Stratum_feature (see 4.2.683), Stratum_feature_template_component (see 5.2.4.161), Stratum_feature_template (see 5.2.4.317), or the shape of a Design_intent_modification (see 5.2.4.408). The shape shall be one or more shell if it is the shape of a Stratum (see 4.2.677). The shape shall be a single shell if it is the shape of a Stratum_average_surface (see 4.2.679). An Open_shell_based_surface guarantees material continuity as the material traverses corners in a three-dimensional model.

4.2.462 Operational_requirement_occurrence_relationship

An Operational_requirement_occurrence_relationship is a type of Managed_design_object (see 4.2.431). An Operational_requirement_occurrence_relationship is the association between one Ee_requirement_-occurrence (see 4.2.283) and another, with a defined type of relationship. An Operational_requirement_-occurrence_relationship is an incompletely modeled concept and shall be combined with members of Requirement_composition (see 5.2.4.49) to form a complete requirement.

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The data associated with an Operational_requirement_occurrence_relationship are the following:

— related_requirement_occurrence;

— relating_requirement_occurrence;

— relationship_type.

4.2.462.1 related_requirement_occurrence

The related_requirement_occurrence specifies the first Ee_requirement_occurrence (see 4.2.283) for the Operational_requirement_occurrence_relationship. The first Ee_requirement_occurrence is the dependent item if the relationship is a dependency relationship.

4.2.462.2 relating_requirement_occurrence

The relating_requirement_occurrence specifies the second Ee_requirement_occurrence (see 4.2.283) for the Operational_requirement_occurrence_relationship. The second Ee_requirement_occurrence is the independent item if the relationship is a dependency relationship.

4.2.462.3 relationship_type

The relationship_type specifies one of the following:

— an AND_OPERATION;

— an OR_OPERATION;

— a DERIVED_FROM relationship.

The mathematical operations AND, OR shall be implemented for this relationship_type. DERIVED_FROM only asserts a dependency relationship. The AND_OPERATION is provided so that changes in relationship_type from OR_OPERATION to AND_OPERATION do not cause a structural change to the populated data. The implicit relationship between two member of Ee_requirement_occurrence that help to compose the same Requirement_group_occurrence is an AND relationship.

Constraints:

WR1: Each member of Operational_requirement_occurrence_relationship shall specify members of Ee_requirement_occurrence that are also specified by a member of Requirement_composition that specifies a member of Requirement_group_occurrence as the composition or result of the operation.

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4.2.463 Opposing_boundary_set_size_characteristic

An Opposing_boundary_set_size_characteristic is a type of Boundary_size_characteristic (see 4.2.60) that defines the distance between the two members of a Tolerance_zone_opposing_boundary_set (see 4.2.745). The two members may or may not be explicitly identified.

The data associated with an Opposing_boundary_set_size_characteristic are the following:

— sized_boundary_set.

4.2.463.1 sized_boundary_set

The sized_boundary_set specifies the Tolerance_zone_opposing_boundary_set (see 4.2.745) of which the distance between its two members is defined by the Opposing_boundary_set_size_characteristic.

Constraints:

WR1: The Tolerance_zone_boundary specified as the sized_boundary_set shall be the same instance of Tolerance_zone_boundary as specified by the defined_zone_boundary of the Boundary_zone_definition_with_specified_size that is specified as the boundary_definition.

NOTE The attribute boundary_definition is declared in the Boundary_size_characteristic entity of which this entity is a subtype.

4.2.464 Organization

An Organization is a type of Managed_design_object (see 4.2.431). An Organization is a collection of persons grouped for a specific purpose.

The data associated with an Organization are the following:

— address;

— identifier.

4.2.464.1 address

The address specifies the string that describes the location where the Organization may be reached by postal mail or in person. The address need not be specified for a particular Organization.

4.2.464.2 identifier

The identifier specifies the name of the Organization.

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EXAMPLE 1 The identifier may be a concatenation of the following: "Country code" = country code (as established by UN); "Organization code name" = identifying name the country gives the code; "Organization code" = organization code (as established by country assigning the organization code); "Sub Organization code" = sub organization code (as established by organization). This illustrates the usage: "Country code" = "USA", "Organization code name" = "CAGE", "Organization code" = "12345", "Sub Organization code" = "Telecommunications".

NOTE Reference ISO 6523 amendment 1:1994.

Constraints:

UR1: The identifier shall be unique within a population of Organizations.

4.2.465 Orientation

An orientation is a type of Managed_design_object (see 4.2.431). An orientation is the relative angular displacement of a Cartesian_coordinate_system (see 4.2.66) from a reference Cartesian_coordinate_system with a coincident origin. Relative angular displacement shall be interpreted as a general direction vector in two-dimensional or three-dimensional space. The actual magnitudes of the components of the vector have no significance; only the ratios among the components are significant.

4.2.466 Package

A Package is a type of a Physical_unit_usage_view (see 4.2.538). A Package may be a Altered_package (see 4.2.5). A Package describes the physical container of a Packaged_part (see 4.2.481). A Package includes no more than one package body and one or more package terminals.

EXAMPLE 1 Figures 62 through 67 illustrate types of Packages and parameters related to Geometric Dimensioning and Tolerancing supported by this part of ISO 10303. ISO 10303-202 would be used in conjunction with this part of ISO 10303 to define the exchange of the presentation information (i.e., the drawings). This part of ISO 10303 supports the direct application to application exchange of the parametric data illustrated in the drawings.

EXAMPLE 2 Figures 85 through 91 illustrate parameters and features related to Package orientation for assembly purposes supported by this part of ISO 10303. ISO 10303-202 would be used in conjunction with this part of ISO 10303 to define the exchange of the presentation information (i.e., the drawings).

NOTE When used for a Packaged_part "white box model", the Part_device (see 5.2.4.225) is installed in the Package and an electrical connection is defined between each terminal on the installed Part_device and one or more terminals on the Package.

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The data associated with a Package are the following:

— body;

— case_style;

— cutout_required;

— least_lead_length_below_seating_plane;

— least_material_condition_centroid_location;

— maximum_body_clearance_above_seating_plane;

— maximum_body_clearance_below_seating_plane;

— maximum_body_height_above_seating_plane;

— maximum_body_height_below_seating_plane;

— maximum_lead_length_below_seating_plane;

— maximum_material_condition_centroid_location;

— minimum_body_clearance_above_seating_plane;

— minimum_body_clearance_below_seating_plane;

— package_accesses;

— package_polarity_indication;

— package_primary_orientation_feature;

— package_seating_plane;

— package_secondary_orientation_feature;

— package_tertiary_orientation_feature;

— through_hole_technology.

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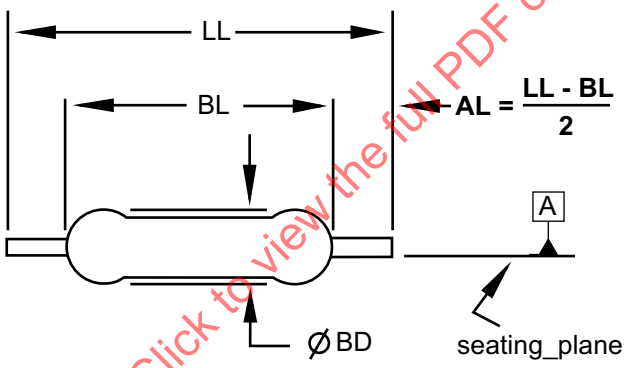

Figure 62 – Axial lead

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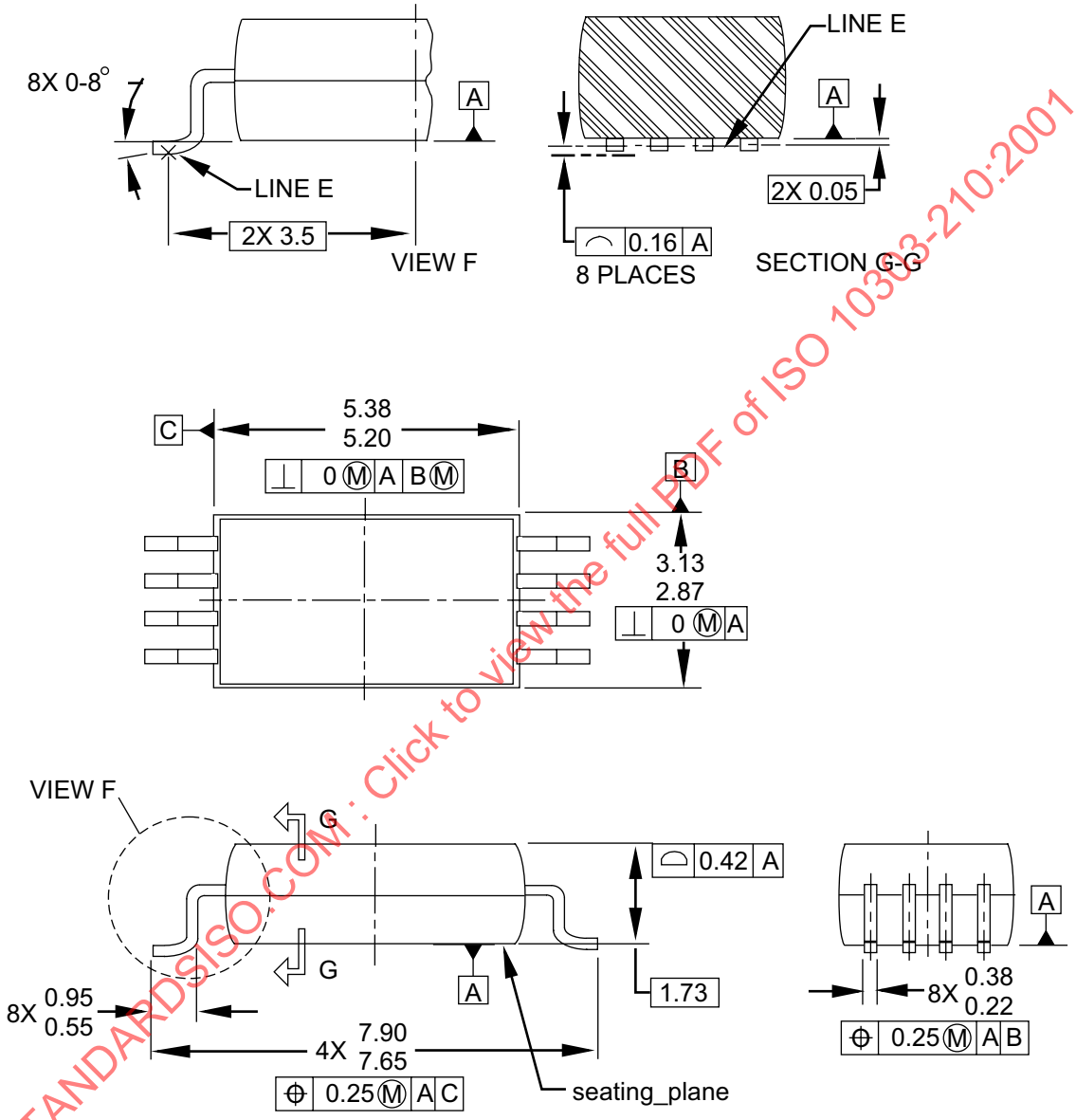

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Figure 63 – Eight lead SOIC

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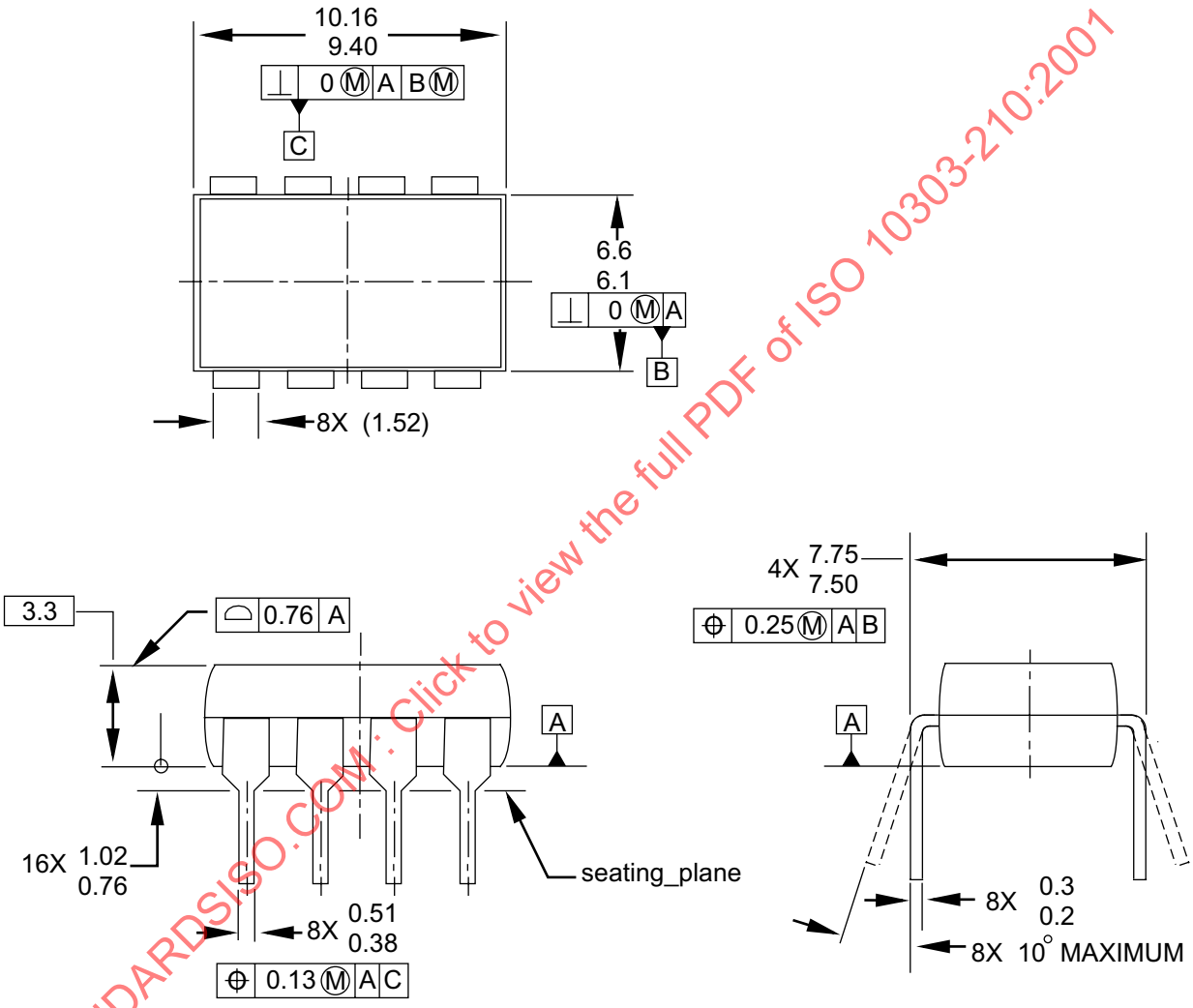

Figure 64 – Eight lead DIP

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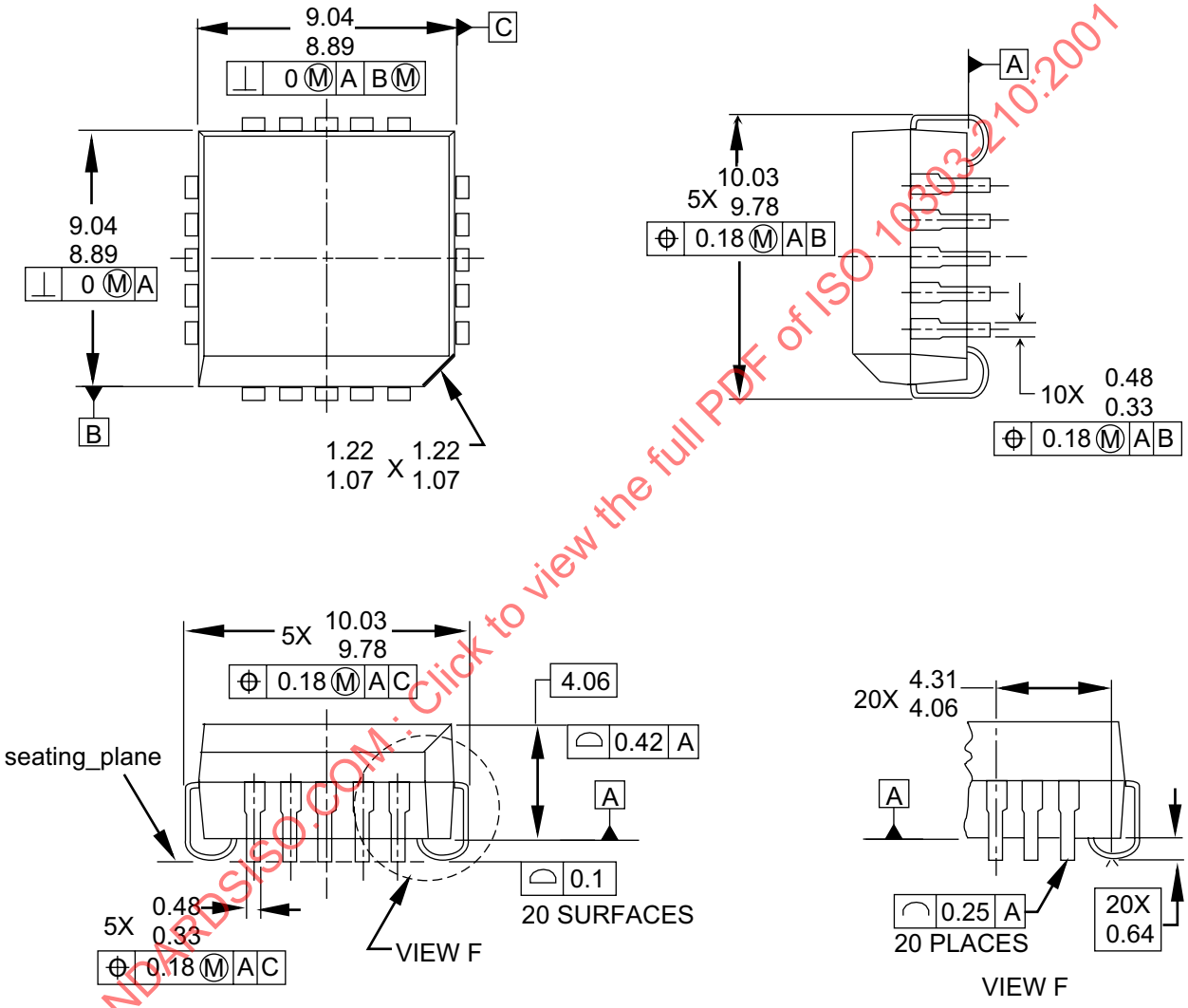

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Figure 65 – Twenty lead reversed J lead

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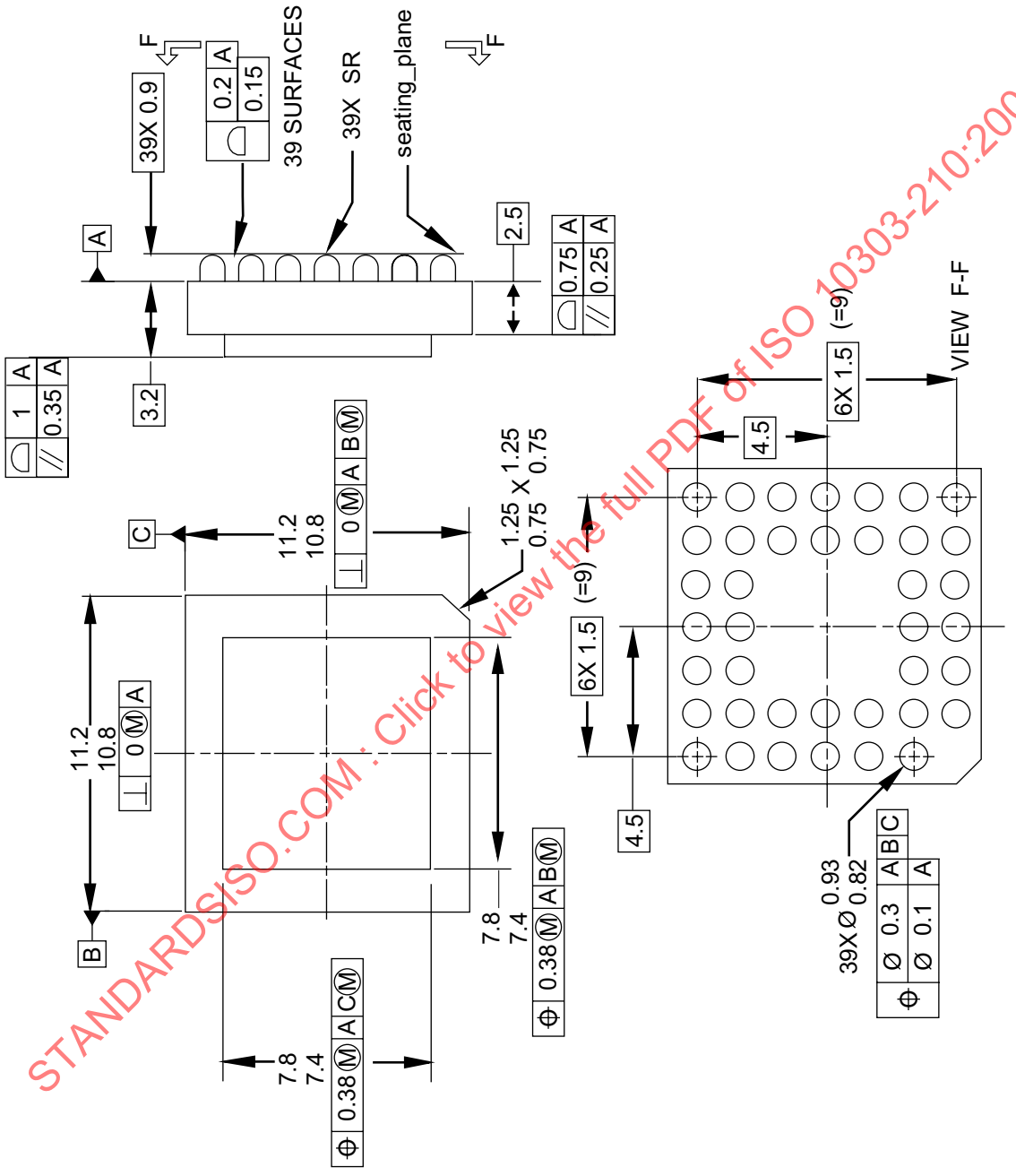

Figure 66 – Ball grid array

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4.2.466.1 body

The body is an inverse relationship that specifies the Package_body (see 4.2.467) that specifies the Package as its associated_definition. There shall be no more than one Package_body for a Package.

4.2.466.2 case_style

The case_style specifies the Registered_style (see 4.2.611) for the documented label for the Package. There shall be one or more Registered_style for a Package.

4.2.466.3 cutout_required

The cutout_required specifies a derived value of TRUE or FALSE, depending on the existence of the optional attribute maximum_body_height_below_seating_plane. If the attribute exists, the value is TRUE. If the attribute is no present, the value is FALSE.

4.2.466.4 least_lead_length_below_seating_plane

The least_lead_length_below_seating_plane is a Length_data_element (see 4.2.422) that specifies the smallest lead length below the seating plane. The least_lead_length_below_seating_plane need not be specified for a particular Package.

4.2.466.5 least_material_condition_centroid_location

The least_material_condition_centroid_location specifies a Cartesian_point that is the location of the center of mass for the minimum material state for the Package. The least_material_condition_centroid_-location need not be specified for a Package.

4.2.466.6 maximum_body_clearance_above_seating_plane

The maximum_body_clearance_above_seating_plane specifies a Length_data_element that is the maximum length between the body and the top of the seating_plane. A maximum_body_clearance_above_-seating_plane need not be specified for a Package.

4.2.466.7 maximum_body_clearance_below_seating_plane

The maximum_body_clearance_below_seating_plane specifies a Length_data_element that is the maximum length between the body and the bottom of the seating_plane. A maximum_body_clearance_below_seating_plane need not be specified for a Package.

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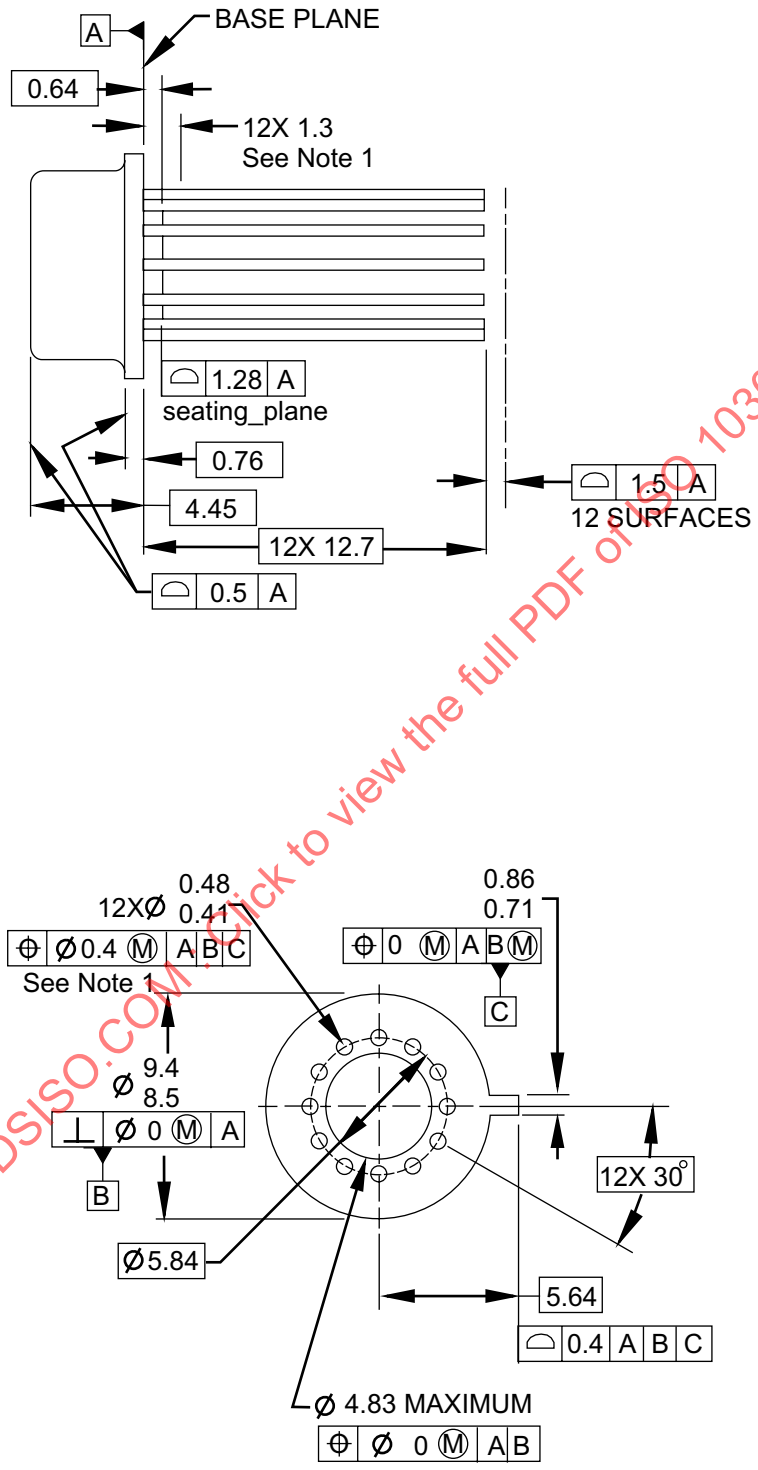

Note 1 : Positional tolerance of leads applies only within distance above base plane specified.

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Figure 67 – T099

4.2.466.8 maximum_body_height_above_seating_plane

The maximum_body_height_above_seating_plane is a Length_data_element (see 4.2.422) that specifies the maximum height of the Package above the seating plane. Since there is no attribute describing the maximum terminal height above the seating plane, this attribute shall be interpreted as the furthest point away from the seating plane of either the body or of any Package_terminal (see 4.2.472) above the seating plane.

EXAMPLE 1 In the case of package to be mounted in a cutout there may only be the surface mounted leads protruding above the seating plane.

4.2.466.9 maximum_body_height_below_seating_plane

The maximum_body_height_below_seating_plane is a Length_data_element (see 4.2.422) that specifies the maximum height of the Package below the seating plane. The maximum_body_height_below_-seating_plane need not be specified for a particular Package.

4.2.466.10 maximum_lead_length_below_seating_plane

The maximum_lead_length_below_seating_plane is a Length_data_element (see 4.2.422) that specifies the maximum lead length below the seating plane. The maximum_lead_length_below_seating_plane need not be specified for a particular Package.

4.2.466.11 maximum_material_condition_centroid_location

The maximum_material_condition_centroid_location specifies a Cartesian_point that is the location of the center of mass for the maximum material state for the Package. The maximum_material_condition_-centroid_location need not be specified for a Package.

4.2.466.12 minimum_body_clearance_above_seating_plane

The minimum_body_clearance_above_seating_plane specifies a Length_data_element (see 4.2.422) that is the minimum length between the body and the seating_plane. A minimum_body_clearance_below_-seating_plane need not be specified for a Package.

4.2.466.13 minimum_body_clearance_below_seating_plane

The minimum_body_clearance_below_seating_plane specifies a Length_data_element that is the minimum length between the body and the seating_plane. A minimum_body_clearance_below_seating_-plane need not be specified for a Package.

4.2.466.14 package_accesses

The package_accesses is an inverse relationship that specifies that the existence of the Package is dependent on the existence of the Package_terminal (see 4.2.472) that specifies the Package as its associated_-definition. There shall be one or more Package_terminal for a Package.

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4.2.466.15 package_polarity_indication

The package_polarity_indication is an inverse relationship that specifies the Part_feature (see 4.2.494) that specifies the Package as its associated_definition. There shall be no more than one Part_feature for a Package in this role.

4.2.466.16 package_primary_orientation_feature

The package_primary_orientation_feature is an inverse relationship that specifies the Part_feature (see 4.2.494) that specifies the Package as its associated_definition. There shall be no more than one Part_-feature for a Package in this role.

4.2.466.17 package_seating_plane

The package_seating_plane specifies the role of the Seating_plane (see 4.2.640) for the Package. The seating_plane simulates the mounting surface for the terminals in the case of surface mounted parts and in the case of through-hole technology, an arbitrarily established mounting surface. Terminals are required to approach the seating_plane from the top, which is the side where the values on the Z axis are positive. Package installation is defined to be only from the top of the seating_plane in order to reduce orientation errors between two-dimensional and three-dimensional models in this part of ISO 10303.

4.2.466.18 package_secondary_orientation_feature

The package_secondary_orientation_feature is an inverse relationship that specifies the Part_feature (see 4.2.494) that specifies the Package as its associated_definition. There shall be no more than one Part_-feature for a Package in this role.

4.2.466.19 package_tertiary_orientation_feature

The package_tertiary_orientation_feature is an inverse relationship that specifies the Part_feature (see 4.2.494) that specifies the Package as its associated_definition. There shall be no more than one Part_-feature for a Package in this role.

4.2.466.20 through_hole_technology

The through_hole_technology specifies a derived value of TRUE or FALSE, depending on the existence of the optional attribute maximum_lead_length_below_seating_plane. If the attribute exists, the value is TRUE. If the attribute is no present, the value is FALSE.

Constraints:

UR1: A member of Registered_style shall not be in the role of case_style for more than one member of Package.

WR1: Only a Primary_orientation_feature shall be in the role of package_primary_orientation_feature.

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WR2: Only a Secondary_orientation_feature shall be in the role of package_secondary_orientation_-feature.

WR3: Only a Polarity_indication_feature shall be in the role of package_polarity_indication.

WR4: The package_primary_orientation_feature shall not be the package_secondary_orientation_feature.

WR5: The package_primary_orientation_feature shall not be the package_tertiary_orientation_feature.

WR6: The package_tertiary_orientation_feature shall not be the package_secondary_orientation_feature.

4.2.467 Package_body

A Package_body is a type of Part_feature (see 4.2.494) that is the encasement used in the realization of a Package (see 4.2.466). The observer view shall be above the seating plane and shall be higher than the highest point of the Package_body.

The data associated with a Package_body are the following:

— associated_definition;

— body_bottom_surface;

— body_material;

— body_top_surface.

4.2.467.1 associated_definition

The associated_definition specifies the role of the Package (see 4.2.466) for the Package_body.

4.2.467.2 body_bottom_surface

The body_bottom_surface specifies the role of a Package_body_bottom_surface (see 4.2.468) for the Package_body. A body_bottom_surface need not be specified for a Package_body.

4.2.467.3 body_material

The body_material specifies the Ee_material (see 4.2.273) used in the manufacture of the Package_body.

4.2.467.4 body_top_surface

The body_top_surface specifies the role of a Package_body_top_surface (see 4.2.470) for the Package_-body. A body_top_surface need not be specified for a Package_body.

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4.2.468 Package_body_bottom_surface

A package_body_bottom_surface is a type of package_body_surface (see 4.2.469) that is not visible from an observer located so as to place the component on a substrate.

4.2.469 Package_body_surface

A Package_body_surface is either a Package_body_top_surface (see 4.2.470) or a Package_body_bottom_surface (see 4.2.468). A Package_body_surface relationship to the seating plane may be explicitly established, helping to unambiguously orient the Packaged_part (see 4.2.481).

The data associated with a Package_body_surface are the following:

— associated_package_body.

4.2.469.1 associated_package_body

The associated_package_body specifies the role of the Package_body (see 4.2.467) for the Package_body_surface.

4.2.470 Package_body_top_surface

A package_body_top_surface is a type of Package_body_surface (see 4.2.469) that is visible from any observer located so as to place the component on a substrate.

4.2.471 Package_external_reference

A Package_external_reference is a type of Managed_design_object (see 4.2.431). A Package_external_reference is an unambiguous reference to the definition of a Package (see 4.2.466) in an external system.

NOTE Package_external_reference is included to permit references to Packaged_part_terminal (see 5.2.4.310) withouth requiring that a geometric representation be present for the terminal.

The data associated with a Package_external_reference are the following:

— design_owner;

— part_number;

— revision_code;

— product_definition_id.

4.2.471.1 design_owner

The design_owner specifies one role of a string for the Package_external_reference. The design_owner controls the assignment of part_number for the Package being referenced.

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4.2.471.2 part_number

The part_number specifies one role of a string for the Package_external_reference. The part_number represents an identifier unique within the organization for packages.

4.2.471.3 revision_code

The revision_code specifies one role of a string for the Package_external_reference. The revision_code represents a version of the package, and together with part_number is unique within the organization for packages.

4.2.471.4 product_definition_id

The product_definition_id specifies one role of a string for the Package_external_reference. The product_definition_id represents the identification of the definition of the Package being referenced.

4.2.472 Package_terminal

A Package_terminal is a type of Part_feature (see 4.2.494). A Package_terminal may be one or more of a Guided_wave_terminal (see 5.2.4.412), a Altered_package_terminal (see 4.2.6), a Wire_terminal (see 4.2.773), or a Primary_reference_terminal (see 4.2.571). When the case or package body is used as a terminal then Package_terminal shall be populated to specify the feature of the Package_body (see 4.2.467) that serves that purpose. The Package_terminal shall be in a sequence, with the initial member being Primary_reference_terminal, and each member that is not a Primary_reference_terminal shall reference a previous member in the sequence using the precedent_feature attribute inherited from Part_feature.

EXAMPLE 1 Figure 68 illustrates a cutaway view of a terminal and shows the characteristics related to a terminal.

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The data associated with a Package_terminal are the following:

— associated_definition;

— external_connection_zone;

— feature_shape;

— internal_connection_zone;

— maximum_terminal_diametrical_extent;

— minimum_terminal_diametrical_extent;

— model_representation;

— terminal_characteristic;

— terminal_core_material;

— terminal_surface_material.

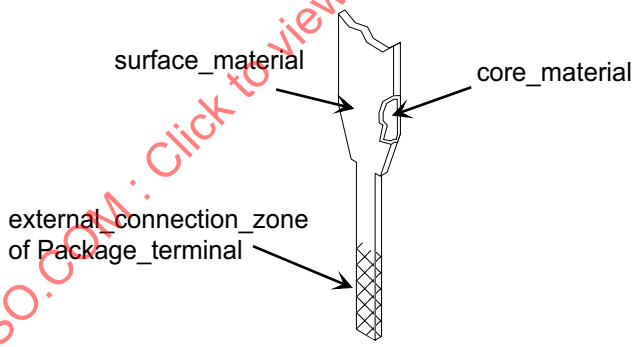

Figure 68 – Package_terminal

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4.2.472.1 associated_definition

The associated_definition specifies the role of the Package (see 4.2.466) for the Package_terminal.

4.2.472.2 external_connection_zone

The external_connection_zone specifies the Connection_zone (see 4.2.147) on the outside surface of the Package_terminal. There may be more than one Connection_zone for a Package_terminal.

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NOTE The Feature_shape_occurrence (see 4.2.316) specified by the terminal or mounting feature may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is the Connection_zone.

4.2.472.3 feature_shape

The feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Package_terminal. There shall be one or more Feature_shape_occurrence for the Package_terminal.

4.2.472.4 internal_connection_zone

The internal_connection_zone_specifies the Connection_zone (see 4.2.147) on the inside portion of the Package_terminal. There may be more than one Connection_zone in the role of internal_connection_zone. The internal_connection_zone need not be specified for a particular Package_terminal.

NOTE The internal_connection_zone is separate from the external_connection_zone.

4.2.472.5 maximum_terminal_diametrical_extent

The maximum_terminal_diametrical_extent specifies the Length_data_element (see 4.2.422) that represents the maximum allowed diameter of a Package_terminal. The Length_data_element need not be specified for a Package_terminal. The Length_data_element is the diameter of a circle that circumscribes the cross-sectional shape of the terminal.

4.2.472.6 minimum_terminal_diametrical_extent

The minimum_terminal_diametrical_extent specifies the Length_data_element (see 4.2.422) that represents the minimum allowed diameter of a Package_terminal. The Length_data_element need not be specified for a Package_terminal. The Length_data_element is the diameter of a circle that circumscribes the cross-sectional shape of the terminal.

4.2.472.7 model_representation

The model_representation specifies the Analytical_representation (see 4.2.16) that embodies the analysis characteristics identified as terminal_characteristics. The model_representation need not be specified for a particular Package_terminal. There may be more than one Analytical_representation for a Package_terminal.

4.2.472.8 terminal_characteristic

The terminal_characteristic specifies the Characteristic (see 4.2.77) of the Package_terminal. The terminal_characteristic need not be specified for a particular Package_terminal. There may be more than one Characteristic for a Package_terminal.

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4.2.472.9 terminal_core_material

The terminal_core_material specifies the role of the Material_assembly_relationship (see 5.2.5.1) for the Package_terminal core material.

4.2.472.10 terminal_surface_material

The terminal_surface_material specifies the role of the Material_assembly_relationship (see 5.2.5.1) for the outer surface of the Package_terminal surface material.

Constraints:

WR1: The Package instance specified by associated_definition shall have a cartesian coordinate system frame of reference.

WR2: The material specified in the terminal_core_material shall be one item in the set of the material inherited from Physical_unit_usage_view.

WR3: The material specified in the terminal_surface_material shall be one item in the set of the material inherited from Physical_unit_usage_view.

4.2.473 Package_terminal_external_reference

A Package_terminal_external_reference is a type of Managed_design_object (see 4.2.431). A Package_terminal_external_reference is an unambiguous reference to a Package_terminal (see 4.2.472) in an external system.

EXAMPLE 1 Items in a Physical_connectivity_definition (see 5.2.4.1) may need to reference terminals in a library without duplicating the geometric context.

The data associated with a Package_terminal_external_reference are the following:

— associated_definition;

— name.

4.2.473.1 associated_definition

The associated_definition specifies the role for a Package_external_reference (see 4.2.471) for the Package_terminal_external_reference.

4.2.473.2 name

The name specifies the role of a string for the Package_terminal_external_reference. The name shall be interpreted as the name attribute inherited by Package_terminal from Shape_element.

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Constraints:

UR1: Each member of Package_terminal_external_reference shall have a unique combination of attributes.

4.2.474 Package_terminal_occurrence

A Package_terminal_occurrence is a type of Managed_design_object (see 4.2.431). A Package_terminal_occurrence is an occurrence of a Package_terminal (see 4.2.472) in a Packaged_component (see 4.2.475) for the case where the equivalent Packaged_part_terminal (see 5.2.4.310) is not populated. This application object is provided to specify the cases where no Packaged_part_terminal is defined for a Package_terminal because there is no access to functionality specified through that Package_terminal. There is a requirement to support the fact that the Assembly_joint (see 4.2.32) connects the realized terminal of the component to the realized terminal of an Interconnect_module_component (see 4.2.373) or to other members of Assembly_component.

The data associated with a Package_terminal_occurrence are the following:

— associated_component;

— definition.

4.2.474.1 associated_component

The associated_component specifies the role of the Packaged_component (see 4.2.475) for the Package_terminal_occurrence.

4.2.474.2 definition

The definition specifies the role of the Package_terminal (see 4.2.472) that has no defined electrical functionality for the Package_terminal_occurrence.

4.2.475 Packaged_component

A Packaged_component is a type of Assembly_component (see 4.2.27). A Packaged_component may be a Packaged_connector_component (see 4.2.478) or additionally a Routed_packaged_component (see 4.2.620). A Packaged_component is an instantiation of a Packaged_part (see 4.2.481) at a given location within the context of a printed circuit assembly.

The data associated with a Packaged_component are the following:

— access_mechanism;

— selected_package_alternate;

— usage_definition.

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4.2.475.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Packaged_component is dependent on the existence of the Packaged_component_join_terminal (see 4.2.476) that specifies the Packaged_component as its associated_component. There shall be one or more Packaged_component_join_terminal for a Packaged_component.

4.2.475.2 selected_package_alternate

The selected_package_alternate specifies the role of the Altered_package (see 4.2.5) for the Packaged_component. The selected_package_alternate need not be specified for a particular Packaged_component.

4.2.475.3 usage_definition

The usage_definition specifies the role of the Packaged_part (see 4.2.481) for the Packaged_component.

Constraints:

WR1: If selected_package_alternate exists, then the selected_package_alternate shall be in the role of used_package for the Packaged_part in the role of usage_definition for the Packaged_component.

4.2.476 Packaged_component_join_terminal

A Packaged_component_join_terminal is a type of Component_terminal (see 4.2.105). A Packaged_component_join_terminal is one termination for a Packaged_component (see 4.2.475). The terminal provides access to the electrical functionality of the packaged part being terminated.

EXAMPLE 1 Figure 69 illustrates a detail of a assembly drawing that shows a microcircuit plugged into a socket, and the role of the Packaged_component_join_terminal.

The data associated with a Packaged_component_join_terminal are the following:

— associated_component;

— definition;

— maximum_wire_terminal_length;

— minimum_wire_terminal_length.

4.2.476.1 associated_component

The associated_component specifies the Packaged_component (see 4.2.475) being accessed by the Packaged_component_join_terminal.

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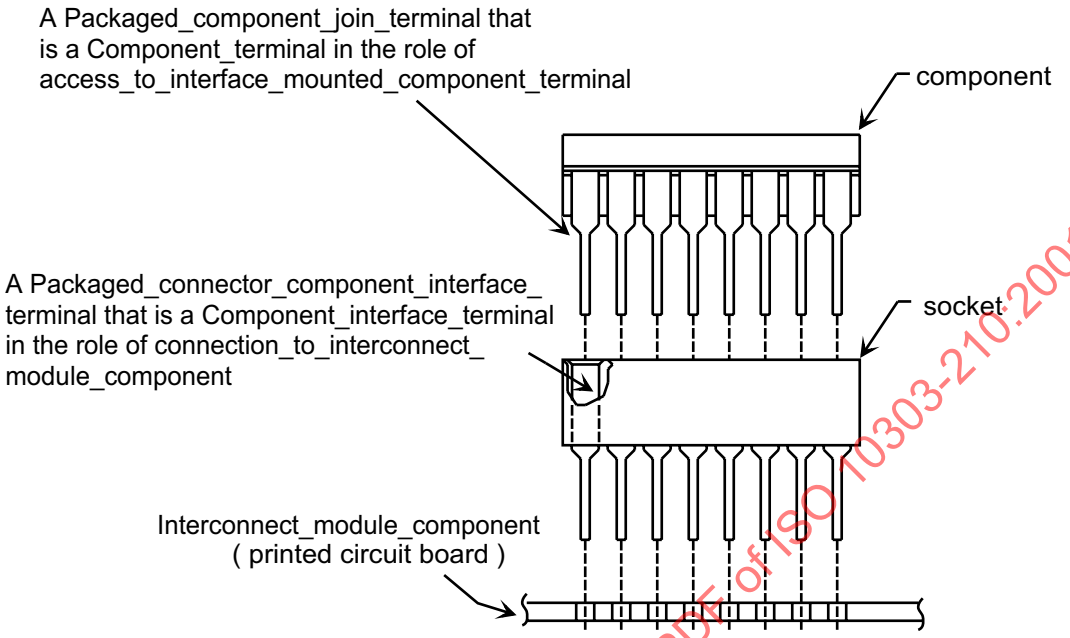

Figure 69 – Packaged_component_join_terminal

4.2.476.2 definition

The definition specifies the role of the Packaged_part_join_terminal (see 4.2.483) for the Packaged_-component_join_terminal.

4.2.476.3 maximum_wire_terminal_length

The maximum_wire_terminal_length specifies the maximum dimension of the Length_data_element (see 4.2.422) of the Packaged_component_join_terminal when the terminal material is a flexible wire. The maximum_wire_terminal_length need not be specified for a particular Packaged_component_join_-terminal.

4.2.476.4 minimum_wire_terminal_length

The minimum_wire_terminal_length specifies the minimum dimension of the Length_data_element (see 4.2.422) of the Packaged_component_join_terminal when the terminal material is a flexible wire. The minimum_wire_terminal_length need not be specified for a particular Packaged_component_join_termi-nal.

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4.2.477 Packaged_connector

A Packaged_connector is a type of Packaged_part (see 4.2.481) whose functionality between certain terminals is defined to be a short by this part of ISO 10303. The short shall be between the interface terminal and the join terminal specified by a member of Packaged_connector_terminal_relationship (see 4.2.480). The short is a logical abstraction for CAD purposes. The detailed functional properties of the connector are defined in the connector specification.

NOTE One use for a Packaged_connector is to provide access to the physical network of the printed circuit assembly from an external source.

EXAMPLE 1 Figure 70 illustrates a Packaged_connector and its usage in a design context as a Packaged_connector_component (see 4.2.478).

The data associated with a Packaged_connector are the following:

— characterized_connector_terminal_relationship.

4.2.477.1 characterized_connector_terminal_relationship

The characterized_connector_terminal_relationship is an inverse relationship that specifies that the existence of the Packaged_connector is dependent on the existence of the Packaged_connector_terminal_relationship (see 4.2.480) that specifies the Packaged_connector as its connector. There shall be one or more Packaged_connector_terminal_relationship for a Packaged_connector.

4.2.478 Packaged_connector_component

A Packaged_connector_component is a type of Packaged_component (see 4.2.475) that is an occurrence of a Packaged_connector (see 4.2.477).

EXAMPLE 1 Figure 71 illustrates a member of Packaged_connector_component that is a socket.

The data associated with a Packaged_connector_component are the following:

— interface_access_mechanism;

— usage_definition.

4.2.478.1 interface_access_mechanism

The interface_access_mechanism is an inverse relationship that specifies that the existence of the Packaged_connector_component is dependent on the existence of the Packaged_connector_component_interface_terminal (see 4.2.479) that specifies the Packaged_connector_component as its associated_component. There shall be one or more Packaged_connector_component_interface_terminal for a Packaged_connector_component.

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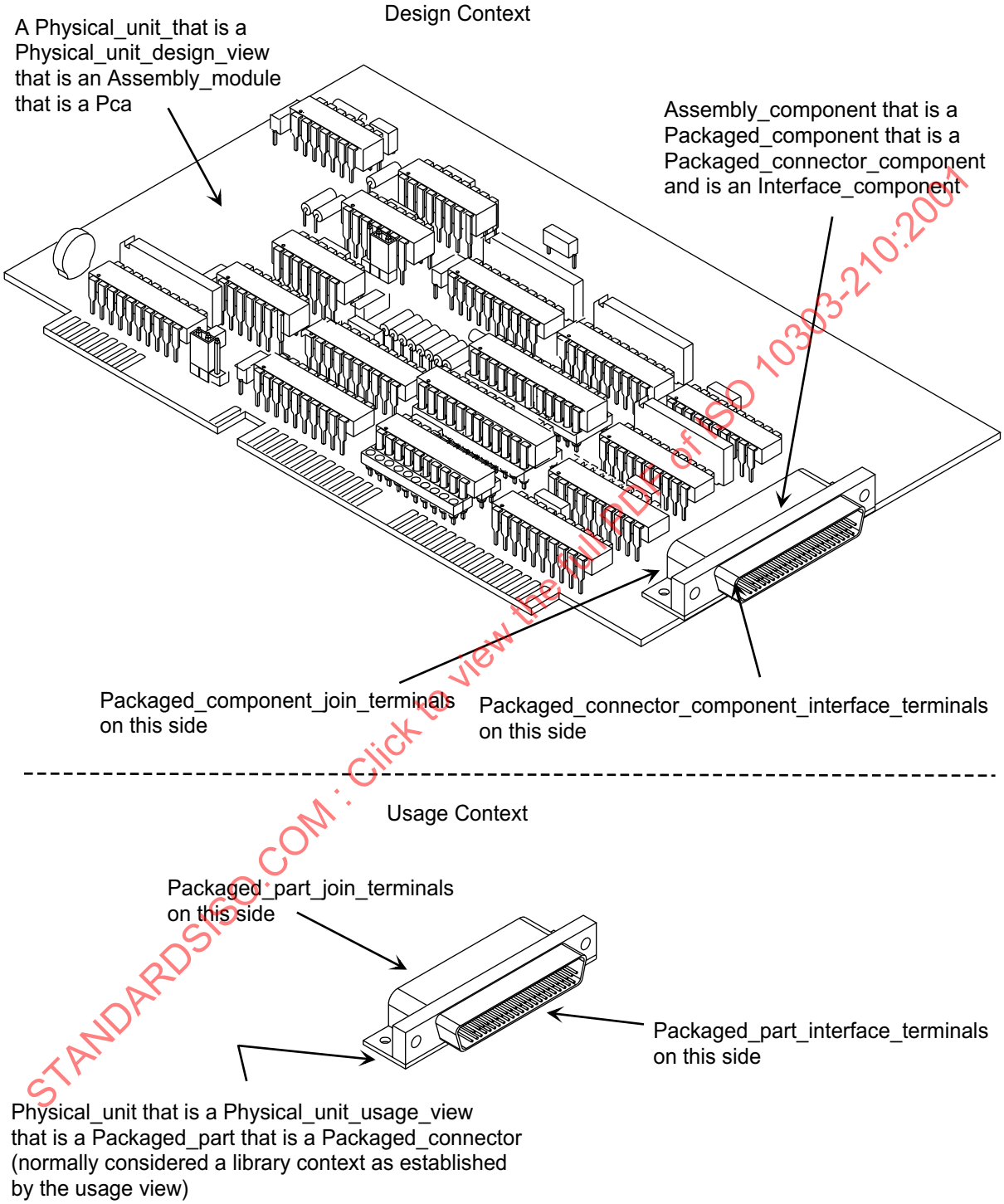

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Figure 70 – Packaged_connector

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4.2.478.2 usage_definition

The usage_definition specifies the role of the Packaged_connector (see 4.2.477) for the Packaged_connector_component.

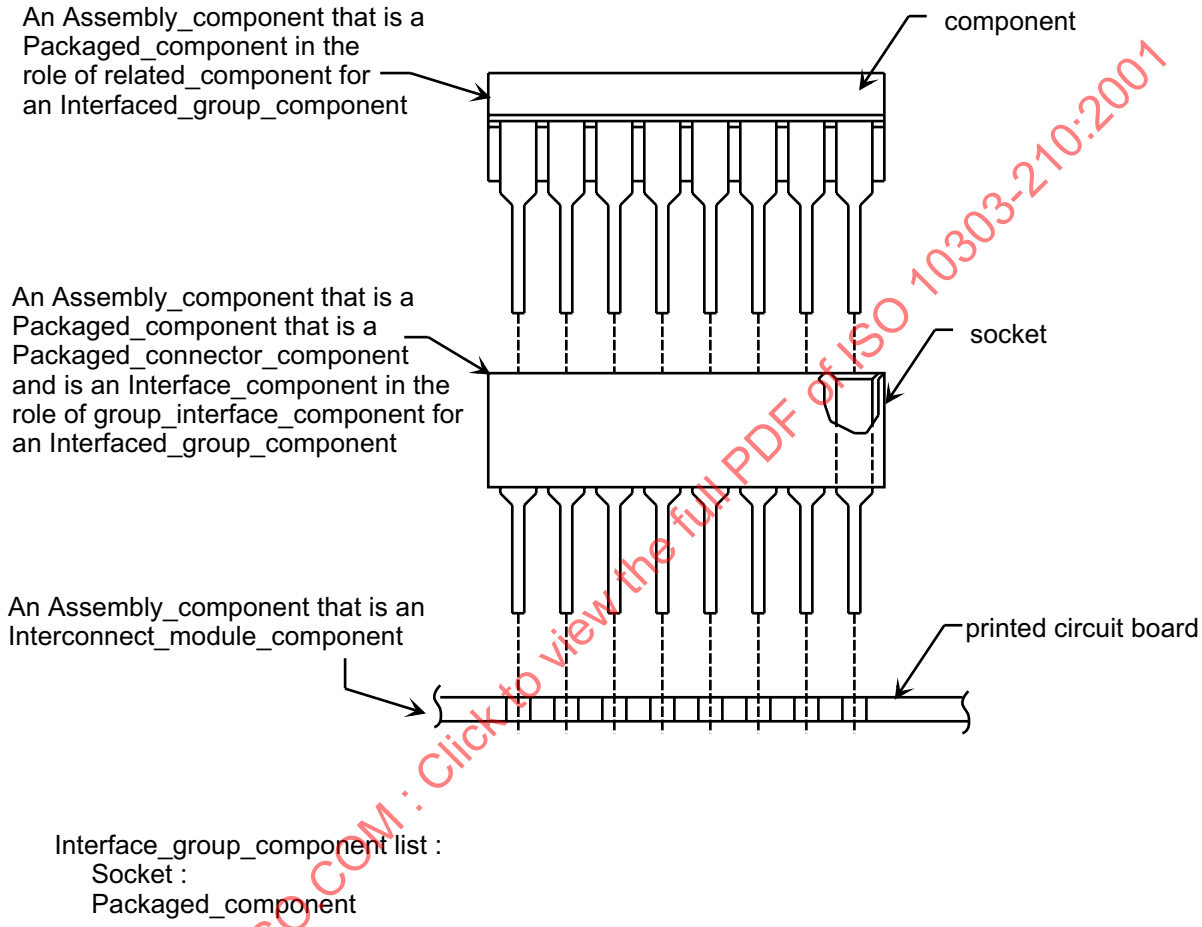

Figure 71 – Packaged_connector_component

4.2.479 Packaged_connector_component_interface_terminal

A Packaged_connector_component_interface_terminal is a type of Component_interface_terminal (see 4.2.97). The Packaged_connector_component_interface_terminal indicates explicitly that the object is an interface terminal of a connector and that the terminal will never be connected to the circuit board or substrate.

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NOTE In the context of system simulation and test, a Packaged_connector_component_interface_terminal may represent a cabling or external connection interface. Further, it provides the exact geometric location of the terminal, whereby the exact geometric location of a mating terminal may be checked to determine whether the physical connection zones of the two interface terminals mate properly.

The data associated with a Packaged_connector_component_interface_terminal are the following:

— associated_component;

— definition.

4.2.479.1 associated_component

The associated_component specifies the role of the Packaged_connector_component (see 4.2.478) for the Packaged_connector_component_interface_terminal.

4.2.479.2 definition

The definition specifies the role of the Packaged_part_interface_terminal (see 4.2.482) for the Packaged_connector_component_interface_terminal.

4.2.480 Packaged_connector_terminal_relationship

A Packaged_connector_terminal_relationship is a type of Managed_design_object (see 4.2.431). A Packaged_connector_terminal_relationship is the association between one interface terminal and a corresponding join terminal of the Packaged_connector (see 4.2.477) that specifies that the two terminals are shorted internally to the Packaged_connector as part of its required functionality. This relationship is an explicit statement of the inherent functionality of a connector. Therefore no separate Functional_unit_network_definition (see 5.2.4.339) or Analytical_model (see 4.2.10) is required to specify the nominal functionality of a connector. A Functional_unit_usage_view (see 4.2.347) may be supplied to support mapping the functional design to the connector join terminals.

NOTE 1 One use for this relationship is to specify the short between the terminal that is installed to the printed circuit assembly and the terminal that provides the access to the outside environment when an occurrence of Packaged_connector is installed in the assembly.

NOTE 2 Installation into the next higher assembly is not necessary to achieve this relationship.

NOTE 3 There is a member of this relationship populated for every pair of terminals in the Packaged_connector.

The data associated with a Packaged_connector_terminal_relationship are the following:

— connector;

— interface_terminal;

— join_terminal.

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4.2.480.1 connector

The connector specifies the Packaged_connector (see 4.2.477) that has the Package_terminal (see 4.2.472) that are defined to be shorted by the Packaged_connector_terminal_relationship.

4.2.480.2 interface_terminal

The interface_terminal specifies the role of the Packaged_part_interface_terminal (see 4.2.482) for the Packaged_connector_terminal_relationship.

4.2.480.3 join_terminal

The join_terminal specifies the role of the Packaged_part_join_terminal (see 4.2.483) for the Packaged_-connector_terminal_relationship.

Constraints:

UR1: The combination of the connector and the join_terminal shall be unique within a population of Packaged_connector_terminal_relationship.

UR2: The combination of the connector and the interface_terminal shall be unique within a population of Packaged_connector_terminal_relationship.

WR1: The Packaged_part associated with the interface_terminal shall be the Packaged_connector specified by connector.

WR2: The Packaged_part associated with the join_terminal shall be the Packaged_connector specified by connector.

4.2.481 Packaged_part

A Packaged_part is a type of a Physical_unit_usage_view (see 4.2.538). A Packaged_part may be a Packaged_connector (see 4.2.477) or additionally an Altered_packaged_part (see 4.2.7). A Packaged_-part describes a part that exists independently from any particular assembly on which it may be used.

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NOTE 1 A Packaged_part sometimes is realized by installing one or more occurrences of Bare_die (see 4.2.47) into a Package_body (see 4.2.467), bonding conductors between appropriate ports on the occurrence of the Bare_-die and Package_terminal (see 4.2.472) on the Package (see 4.2.466), filling the void between the occurrences of the Bare_die and the Package_body with an insulating potting material, and marking the realization with an identifier. See Figure 72 for an illustration of a cutaway view of a Packaged_part.

NOTE 2 Two Packaged_part models may be exchanged with this part of ISO 10303, depending on usage. One may support the exchange information that maps the functionality of the Packaged_part to the bare_die, or dies, included in the Packaged_part; and information that maps the terminals of those instances of Bare_die to the terminals of the Packaged_part. This mechanism provides maximum flexibility and information exchange and is characterized as a "white box" model. This model is primarily included in the standard to support design to analysis activities. Alternatively, one may map the functionality required directly to the Packaged_part terminals, and not populate the Bare_die. This is simpler, but does not provide as much information and is characterized as the "black box" model.

The data associated with a Packaged_part are the following:

— access_mechanisms;

— implemented_function;

— potting_compound;

— used_package.

4.2.481.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Packaged_part is dependent on the existence of the Packaged_part_terminal (see 5.2.4.310) that specifies the Packaged_-part as its associated_definition. There shall be one or more Packaged_part_terminal for a Packaged_part.

4.2.481.2 implemented_function

The implemented_function specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Packaged_part. The function specified shall be that mapped by the functional view terminal to physical view terminal allocation requirement.

4.2.481.3 potting_compound

The potting_compound specifies the Ee_material (see 4.2.273) that is used to support the enclosed Bare_-die (see 4.2.47) in the Packaged_part. The potting_compound need not be specified for a particular Packaged_part. The potting_compound may form the Package_body (see 4.2.467) itself for some technologies when the Package_body is molded from the potting_compound.

4.2.481.4 used_package

The used_package specifies the Package (see 4.2.466) of the Packaged_part.

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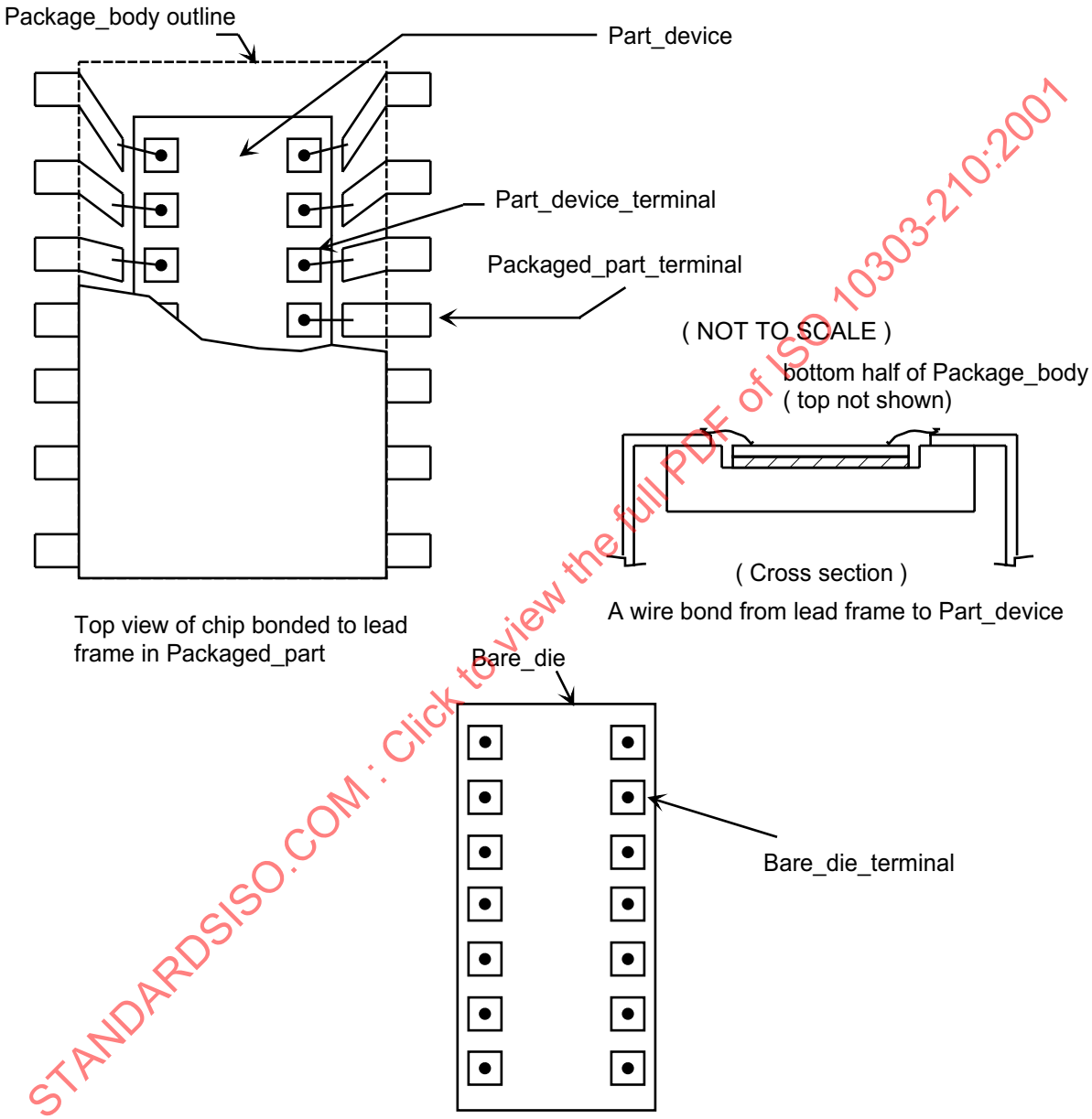

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Figure 72 – Packaged_part exploded assembly detail

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Constraints:

UR1: The combination of implemented_function and used_package shall be unique within a population of Packaged_part.

WR1: The function implemented shall be the function whose terminals are mapped to the terminals of this Packaged_part.

4.2.482 Packaged_part_interface_terminal

A Packaged_part_interface_terminal is a type of Packaged_part_terminal (see 5.2.4.310) that is a terminal of a Packaged_connector (see 4.2.477). An occurrence of the Packaged_part_interface_terminal provides access to the functionality of the assembly into which an occurrence of a Packaged_connector is installed.

The data associated with a Packaged_part_interface_terminal are the following:

— external_connector_function.

4.2.482.1 external_connector_function

The external_connector_function is an inverse relationship that specifies that the existence of the Packaged_part_interface_terminal is dependent on the existence of the Packaged_connector_terminal_relationship (see 4.2.480) that specifies the Packaged_part_interface_terminal as its interface_terminal. There shall be one or more Packaged_connector_terminal_relationship for a Packaged_part_interface_terminal.

NOTE One interface terminal may be connected to several join terminals by members of Packaged_connector_terminal_relationship.

4.2.483 Packaged_part_join_terminal

A Packaged_part_join_terminal is a type of Packaged_part_terminal (see 5.2.4.310) such that an occurrence of the Packaged_part_terminal shall not be in the role of an external interface when the occurrence of the associated Packaged_connector (see 4.2.477) is a component in an assembly.

The data associated with a Packaged_part_join_terminal are the following:

— internal_connector_function.

4.2.483.1 internal_connector_function

The internal_connector_function is an inverse relationship that specifies the Packaged_connector_terminal_relationship (see 4.2.480) that specifies the Packaged_part_join_terminal as its join_terminal. There shall be no more than one Packaged_connector_terminal_relationship for a Packaged_part_join_terminal.

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4.2.484 Packaged_part_terminal

A Packaged_part_terminal is a type of Part_terminal (see 4.2.502) that describes a terminal of a Packaged_part (see 4.2.481). A Packaged_part_terminal is one of a Packaged_part_interface_terminal (see 4.2.482) or a Packaged_part_join_terminal (see 4.2.483).

The data associated with a Packaged_part_terminal are the following:

— associated_definition;

— terminal_connection_zone;

— terminal_of_package.

4.2.484.1 associated_definition

The associated_definition specifies the Packaged_part (see 4.2.481) that has the Packaged_part_terminal.

4.2.484.2 terminal_connection_zone

The terminal_connection_zone specifies the Connection_zone (see 4.2.147) of the Packaged_part_terminal. There may be more than one Connection_zone for a Packaged_part_terminal. The terminal_connection_zone need not be specified for a particular Packaged_part_terminal.

4.2.484.3 terminal_of_package

The terminal_of_package specifies the role of either the Package_terminal (see 4.2.472) or the Package_terminal_external_reference (see 4.2.473)for the Packaged_part_terminal.

Constraints:

WR1: The Package specified by the Packaged_part in the role of associated_definition as used_package shall also be specified by the Package_terminal in the role of terminal_of_package as associated_definition.

WR2: The precedent_feature attribute inherited from Part_feature shall not exist.

4.2.485 Parallel_shape_element_relationship

A Parallel_shape_element_relationship is a type of Shape_element_relationship (see 5.2.4.169) that asserts that two Shape_element (see 4.2.645) are parallel to each other. One Shape_element is specified as the related_shape_element and the other Shape_element is specified as the relating_shape_element.

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NOTE 1 The attribute related_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

NOTE 2 The attribute relating_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

Constraints:

WR1: The Shape_element specified as the relating_shape_element shall not be specified as parallel to itself either directly or through intermediate Parallel_shape_element_relationship.

4.2.486 Parallelism_tolerance

A Parallelism_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on the parallelism of a Shape_element (see 4.2.645) in relation to a Datum_plane (see 5.2.4.129) or Datum_axis (see 4.2.177).

NOTE Parallelism tolerance is defined in terms of tolerance zone definitions in 14.7 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Centre_axis, Centre_-plane, Physical_feature_or_part_template, or Tangent_plane.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: There shall be at most two Datum in the Datum_system the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system entity of which this entity is a subtype.

WR3: At least one Datum_plane or Datum_axis shall be in the Datum_system the definition of which is specified as the datum_system_definition.

WR4: If the toleranced_shape_element is a Centre_plane, Physical_feature_or_part_template, or Tangent_plane, the Parallelism_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_-or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_-definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_-boundary_size.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a parallelism tolerance is sensible.

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4.2.487 Parameter_assignment

A Parameter_assignment is a type of Managed_design_object (see 4.2.431). A Parameter_assignment is the association of either a Characteristic (see 4.2.77) or Coordinated_characteristic (see 5.2.4.383) with a Model_parameter (see 4.2.451), used to provide actual values for characteristics declared formally by the the Model_parameter.

The data associated with a Parameter_assignment are the following:

— assigned_parameter;

— parameter_value.

4.2.487.1 assigned_parameter

The assigned_parameter specifies the Model_parameter (see 4.2.451) that declares the formal parameters assigned values by the Parameter_assignment.

4.2.487.2 parameter_value

The parameter_value specifies either the role of a Characteristic (see 4.2.77) or a Coordinated_characteristic (see 5.2.4.383) for the Parameter_assignment.

Constraints:

WR1: The type of the parameter_value shall be the same as that of the assigned_parameter.

4.2.488 Part_array_feature

A Part_array_feature is a type of Part_group_feature (see 5.2.4.247) that is an array of Part_feature (see 4.2.494) whose positions are specified as members of an array, and whose tolerances are applied based upon the array nature of Part_array_feature.

NOTE Tolerances applied to Part_array_feature are specified by an object external to the Part_array_feature.

4.2.489 Part_based_constraint_occurrence

A Part_based_constraint_occurrence is a type of Constraint_occurrence (see 5.2.4.116) that has a basis in the characteristics of an Ee_product (see 4.2.274) and that identifies the basis product.

The data associated with a Part_based_constraint_occurrence are the following:

— constraining_part.

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4.2.489.1 constraining_part

The constraining_part specifies the role of the Ee_product (see 4.2.274) for the Part_based_constraint_-occurrence.

4.2.490 Part_connected_terminals_definition

A Part_connected_terminals_definition is a type of Managed_design_object (see 4.2.431). A Part_-connected_terminals_definition is the association between two or more Part_terminal (see 4.2.502) that are connected internally to the part. This object serves as a formal requirement statement for connections implemented by a product. It is a topological abstraction in that it does not provide any information stating the variation of properties with respect to product or environmental variability.

NOTE This object is included to support the case where multiple terminals of a part are connected internally (e.g VCC, Ground) to facilitate mapping between the physical terminal definition and the functional terminal definition.

The data associated with a Part_connected_terminals_definition are the following:

— connected_terminals;

— name.

4.2.490.1 connected_terminals

The connected_terminals specifies the role of the Part_terminal (see 4.2.502) for the Part_connected_ter-minals_definition. There shall be two or more Part_terminal for a Part_connected_terminals_definition.

4.2.490.2 name

The name identifies the Part_connected_terminals_definition.

Constraints:

UR1: The name shall be unique within a population of Part_connected_terminals_definitions.

WR1: All terminals specified by the member of this object shall be on the same part.

WR2: All terminals specified by the member of this object shall be mapped to the same terminal of the functional definition.

4.2.491 Part_device

A Part_device is a type of Managed_design_object (see 4.2.431). A Part_device is a specific occurrence of a Bare_die (see 4.2.47) in a Packaged_part (see 4.2.481).

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The data associated with a Part_device are the following:

— bonding_agent;

— defined_packaged_part;

— device_2d_position;

— device_3d_position;

— included_device;

— item_identification.

4.2.491.1 bonding_agent

The bonding_agent specifies the Ee_material (see 4.2.273) used to attach the Bare_die (see 4.2.47) within the Packaged_part (see 4.2.481). The bonding_agent need not be specified for a particular Part_device.

4.2.491.2 defined_packaged_part

The defined_packaged_part specifies the Packaged_part (see 4.2.481) that contains this Part_device.

4.2.491.3 device_2d_position

The device_2d_position is an inverse relationship that specifies the existence of the Device_2d_position (see 5.2.4.190) that specifies the Part_device as its placed_device. There shall be no more than one Device_2d_position for a Part_device.

4.2.491.4 device_3d_position

The device_3d_position is an inverse relationship that specifies the existence of the Device_3d_position (see 5.2.4.239) that specifies the Part_device as its placed_device. There shall be no more than one Device_3d_position for a Part_device.

4.2.491.5 included_device

The included_device specifies the Bare_die (see 4.2.47) used to provide the function of the Part_device.

4.2.491.6 item_identification

The item_identification specifies the name for the reference designation of the Bare_die instance within the Packaged_part.

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Constraints:

UR1: The combination of the defined_package_part and the item_identification shall be unique within a population of Part_devices.

4.2.492 Part_device_terminal

A Part_device_terminal is a type of Managed_design_object (see 4.2.431). A Part_device_terminal is the surface area on an occurrence of a Bare_die (see 4.2.47) in a Packaged_part (see 4.2.481) that shall allow access to the function of an occurrence of the Bare_die. A Part_device_terminal is included to support detaild modeling and analysis of the internal connection to a Packaged_part_terminal. No connection between Part_device_terminals is supported in this part of ISO 10303. Connections between Bare_die are supported only within Assembly_module.

The data associated with a Part_device_terminal are the following:

— terminated_device;

— used_bare_die_terminal.

4.2.492.1 terminated_device

The terminated_device specifies the Part_device (see 5.2.4.225) that has this Part_device_terminal.

4.2.492.2 used_bare_die_terminal

The used_bare_die_terminal specifies the Bare_die_terminal (see 4.2.50) that shall be used by the Part_-device_terminal.

Constraints:

UR1: The combination of the terminated_device and the used_bare_die_terminal shall be unique within a population of Part_device_terminals.

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4.2.493 Part_device_terminal_model_port_assignment

A Part_device_terminal_model_port_assignment is a type of Managed_design_object (see 4.2.431). A Part_device_terminal_model_port_assignment is the relationship between the Analytical_model_port (see 4.2.11) and the Part_device_terminal (see 5.2.4.259), for the purpose of supporting behavioural simulation of bond wire and lead frame effects in a full package simulation. A simulation model provides an explicitly defined functional block that acts as the interface between the Part_device_terminals that are the access mechanisms of the Part_device and the Packaged_part_terminals that are the access mechanisms of the Packaged_part. This is appropriate where there is no detailed physical information available. The purpose, fidelity, and accuracy of the simulation model are not predefined in this part of ISO 10303.

NOTE 1 The Device_terminal_map (see 5.2.4.241) is the mechanism provided in this part of ISO 10303 for defining the "internal" surface of the Package_terminal (see 4.2.472) as used in a Packaged_part (see 4.2.481) since the design of a Packaged_part is outside the scope of this part of ISO 10303.

NOTE 2 Various manufacturers provide simulation models for the combination of leadframe and IC bond whose internal connection may be referenced by this object and whose external connection may be assigned to the Package_terminal by the Part_feature_model_port_assignment (see 5.2.4.164) object.

NOTE 3 This part of ISO 10303 does not specify the physical details of the connection from the Package_terminal to the Part_device_terminal since that is outside the scope of the Packaged_part Application Object.

NOTE 4 A single IC package design definition (e.g. Ball-grid design definition) may be exchanged with this part of ISO 10303 by considering the package to be an Interconnect_module (see 4.2.372).

The data associated with a Part_device_terminal_model_port_assignment are the following:

— internal_connection;

— internal_port.

4.2.493.1 internal_connection

The internal_connection specifies the role of the Part_device_terminal (see 5.2.4.259) for the Part_device_terminal_model_port_assignment.

4.2.493.2 internal_port

The internal_port specifies the role of the Analytical_model_port (see 4.2.11) for the Part_device_terminal_model_port_assignment.

Constraints:

UR1: The combination of the internal_connection and the internal_port shall be unique within a population of Part_device_terminal_model_port_assignment.

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4.2.494 Part_feature

A Part_feature is a type of Physical_feature_or_part_template (see 4.2.527). A Part_feature may be one or more of a Part_group_feature (see 5.2.4.247), a Part_mounting_feature (see 4.2.497), a Part_tooling_feature (see 5.2.4.322), a Thermal_feature (see 4.2.724), a Package_terminal (see 4.2.472), or a Part_terminal (see 4.2.502); or additionally one of a Primary_orientation_feature (see 4.2.570), or a Package_body (see 4.2.467), or an Interconnect_module_surface_feature (see 5.2.4.105).

NOTE 1 A Part_feature is a distinctive aspect of a Physical_unit (see 4.2.533) that partially supports the choice of that Physical_unit in the design.

NOTE 2 The design_view_definition_component_feature and design_view_definition_stratum_concept should only be populated for design archival and should not normally be publicly available as they allow queries against detailed design data.

The data associated with a Part_feature are the following:

— associated_definition;

— design_view_definition_component_feature;

— design_view_definition_stratum_concept;

— feature_shape;

— name;

— precedent_feature.

4.2.494.1 associated_definition

The associated_definition specifies the Physical_unit_usage_view (see 4.2.538) for the targeted Part_feature.

4.2.494.2 design_view_definition_component_feature

The design_view_definition_component_feature is an inverse relationship that specifies the Component_feature_to_physical_usage_view_assignment (see 4.2.95) that specifies the Part_feature as its defined_part_feature. There shall be no more than one Component_feature_to_physical_usage_view_assignment for a Part_feature.

4.2.494.3 design_view_definition_stratum_concept

The design_view_definition_stratum_concept is an inverse relationship that specifies the Stratum_concept_to_physical_usage_view_assignment (see 5.2.4.136) that specifies the Part_feature as its defined_part_feature. There shall be no more than one Stratum_concept_to_physical_usage_view_assignment for a Part_feature.

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4.2.494.4 feature_shape

The feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Part_feature. The feature_shape need not be specified for a particular Part_feature. There may be more than one Feature_shape_occurrence for a Part_feature.

4.2.494.5 name

The name specifies the descriptive label recognizable within the electronics community and by a computer system for the Part_feature. The name is a redeclaration of the name attribute inherited from Shape_element and shall be interpreted as the name attribute of shape_aspect.

4.2.494.6 precedent_feature

The precedent_features specifies the role of the Part_feature for the Part_feature. The precedent_feature need not be specified for a particular Part_feature.

Constraints:

UR1: The combination of the associated_definition and the name shall be unique within a population of Part_features.

WR1: The shape of features shall be consistent with the shape of the physical_unit_usage_view defined by associated_definition.

WR2: The Part_feature shall not participate in a cyclic relationship with the precedent_feature, either directly or indirectly.

WR3: Each Part_feature shall not be assigned by both a Stratum_concept_to_physical_usage_view_assignment and a Component_feature_to_physical_usage_view_assignment.

4.2.495 Part_feature_model_port_assignment

A Part_feature_model_port_assignment is a type of Managed_design_object (see 4.2.431). A Part_feature_model_port_assignment is the relationship between an Analytical_model_port (see 4.2.11) and the Part_feature (see 4.2.494).

NOTE Usually a simulation model is associated on a one to one basis with the Physical_unit_usage_view.

The data associated with a Part_feature_model_port_assignment are the following:

— source;

— target.

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4.2.495.1 source

The source specifies the Part_feature (see 4.2.494) whose port is to be associated with an Analytical_-model_port (see 4.2.11) in a Part_feature_model_port_assignment.

4.2.495.2 target

The target specifies the Analytical_model_port (see 4.2.11) that is to be associated with a Part_feature (see 4.2.494) in a Part_feature_model_port_assignment.

4.2.496 Part_group_feature

A Part_group_feature is a type of Part_feature (see 4.2.494) that is an aggregation of Part_features. A Part_group_feature may be a Part_array_feature (see 4.2.488).

4.2.497 Part_mounting_feature

A Part_mounting_feature is a type of Part_feature (see 4.2.494) that is identified to facilitate tolerance specification when an occurrence of the associated part is used in an assembly.

NOTE The use of high density surface mount parts may require specification of mechanical mounting areas in addition to electrical terminals.

The data associated with a Part_mounting_feature are the following:

— mounting_connection_area.

4.2.497.1 mounting_connection_area

The mounting_connection_area specifies the role of the Connection_zone (see 4.2.147) for the Part_-mounting_feature. The mounting_connection_area provides a means to geometrically specify a surface area for critical mechanical mounting properties.

NOTE The Feature_shape_occurrence (see 4.2.316) specified by the mounting feature may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole mounting feature is the Connection_zone.

4.2.498 Part_template

A Part_template is a type of Library_item (see 5.2.4.52) and is a type of Physical_feature_or_part_template (see 4.2.527). A Part_template may be one of an Inter_stratum_feature_template (see 5.2.4.76), a Material_addition_feature_template (see 4.2.434), a Material_removal_feature_template (see 4.2.439), a Printed_part_template (see 5.2.4.355), a Special_symbol_part_template (see 4.2.668), a Stratum_feature_template (see 5.2.4.317), or a Trace_template (see 5.2.4.29), or additionally may be a Part_text_-template (see 5.2.4.282). One reason for including information provided by members of Part_template is that they are collectors for shape data templates for layout items.

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The data associated with a Part_template are the following:

— analytical_part_template_representation;

— part_template_analytical_model;

— physical_characteristic.

4.2.498.1 analytical_part_template_representation

The analytical_part_template_representation specifies the role of the Analytical_representation (see 4.2.16) for the Part_template. There may be more than one Analytical_representation for the Part_template. The analytical_part_template_representation need not be specified for a particular Part_template.

4.2.498.2 part_template_analytical_model

The part_template_analytical_model specifies the role of the Analytical_model (see 4.2.10) for the Part_-template. The part_template_analytical_model need not be specified for a particular Part_template.

4.2.498.3 physical_characteristic

The physical_characteristic specifies either the Characteristic (see 4.2.77) or Coordinated_characteristic (see 5.2.4.383) for the Part_template. There may be more than one Characteristic for the Part_template. The physical_characteristic need not be specified for a particular Part_template.

Constraints:

UR1: The combination of the name attribute inherited from Shape_element and the library inherited from Library_item shall be unique within a population of Part_template.

WR1: If the item_name that is inherited from Library_item is provided, then it shall be equal to the name attribute inherited from Shape_element.

4.2.499 Part_template_3d_shape

A Part_template_3d_shape is a type of Managed_design_object (see 4.2.431). A Part_template_3d_-shape is the shape in three dimensions of the Part_template (see 4.2.498).

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The data associated with a Part_template_3d_shape are the following:

— shape_characterized_part_template;

— shape_environment;

— shape_material_condition;

— shape_representation.

4.2.499.1 shape_characterized_part_template

The shape_characterized_part_template specifies the role of the Part_template (see 4.2.498) for the Part_-template_3d_shape.

4.2.499.2 shape_environment

The shape_environment specifies either manufacturing or the end_user_application as the environment in which the Part_template_3d_shape is valid. The shape_environment need not be specified for a particular Part_template_3d_shape.

4.2.499.3 shape_material_condition

The shape_material_condition specifies either the maximum_material_condition, the minimum_material_condition or the nominal_material_condition as the material condition for the Part_template_3d_-shape.

4.2.499.4 shape_representation

The shape_representation specifies the Bound_volume_shape (see 4.2.58) that is the model for the Part_-template_3d_shape.

4.2.500 Part_template_non_planar_2d_shape

A Part_template_non_planar_2d_shape is a type of Managed_design_object (see 4.2.431). A Part_-template_non_planar_2d_shape is the shape of a Part_template (see 4.2.498) that is represented in the form of a surface.

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The data associated with a Part_template_non_planar_2d_shape are the following:

— shape_characterized_part_template;

— shape_environment;

— shape_material_condition;

— shape_representation;

— transformation.

4.2.500.1 shape_characterized_part_template

The shape_characterized_part_template specifies the role of the Part_template (see 4.2.498) for the Part_-template_non_planar_2d_shape.

4.2.500.2 shape_environment

The shape_environment specifies either manufacturing or an end_user_application as the valid environment for the Part_template_non_planar_2d_shape. The shape_environment need not be specified for a particular Part_template_non_planar_2d_shape.

4.2.500.3 shape_material_condition

The shape_material_condition specifies either the maximum_material_condition, the minimum_material_condition, or the nominal_material_condition as the material condition for the Part_template_non_-planar_2d_shape.

4.2.500.4 shape_representation

The shape_representation specifies the Open_shell_based_surface (see 5.2.4.39) that is the model for the Part_template_non_planar_2d_shape.

4.2.500.5 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Part_template_non_-planar_2d_shape.

4.2.501 Part_template_planar_shape

A Part_template_planar_shape is a type of Managed_design_object (see 4.2.431). A Part_template_-planar_shape is the planar shape of a Part_template (see 4.2.498).

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The data associated with a Part_template_planar_shape are the following:

— shape_characterized_part_template;

— shape_environment;

— shape_material_condition;

— shape_representation.

4.2.501.1 shape_characterized_part_template

The shape_characterized_part_template specifies the role of the Part_template (see 4.2.498) for the Part_-template_planar_shape.

4.2.501.2 shape_environment

The shape_environment specifies either manufacturing or an end_user_application as the valid environment for the Part_template_planar_shape. The shape_environment need not be specified for a particular Part_template_planar_shape.

4.2.501.3 shape_material_condition

The shape_material_condition specifies either the maximum_material_condition, the minimum_material_condition, or the nominal_material_condition as the material condition for the Part_template_planar_shape.

4.2.501.4 shape_representation

The shape_representation specifies the Planar_projected_shape (see 5.2.4.45) that is the model for the Part_template_planar_shape.

4.2.502 Part_terminal

A Part_terminal is a type of Part_feature (see 4.2.494). A Part_terminal is one of an Assembly_-module_terminal (see 4.2.37), a Bare_die_terminal (see 4.2.50), an Interconnect_module_terminal (see 5.2.4.211), or a Packaged_part_terminal (see 5.2.4.310).

The data associated with a Part_terminal are the following:

— connection_requirement;

— functional_usage_view_terminal.

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4.2.502.1 connection_requirement

The connection_requirement is an inverse relationship that specifies the Part_connected_terminals_definition (see 5.2.4.180) that specifies the Part_terminal as its connected_terminals. There shall be no more than one Part_connected_terminals_definition for a Part_terminal.

4.2.502.2 functional_usage_view_terminal

The functional_usage_view_terminal is an inverse relationship to the Functional_usage_view_to_part_terminal_assignment (see 5.2.4.342) that specifies the Part_terminal as its physical_usage_view_terminal. There shall be no more than one Functional_usage_view_to_part_terminal_assignment (see 5.2.4.342) for a Part_terminal.

4.2.503 Part_terminal_external_reference

A Part_terminal_external_reference is a type of Managed_design_object (see 4.2.431). A Part_terminal_external_reference is an unambiguous reference to a Part_terminal (see 4.2.502) or to a terminal associated with a type of Part_template (see 4.2.498) in an external system. A Part_terminal_external_reference specifies the type of the terminal as well as the identification for the terminal.

EXAMPLE 1 Items in a design definition may need to reference terminals in a library without duplicating the geometric context, and may need to specify terminal types by reference instead of explicit instantiation.

The data associated with a Part_terminal_external_reference are the following:

— associated_definition;

— feature_name;

— feature_type.

4.2.503.1 associated_definition

The associated_definition specifies the role of either a Part_template (see 4.2.498) or a Physical_unit (see 4.2.533) for the Part_terminal_external_reference.

4.2.503.2 feature_name

The feature_name specifies the role of a string as identification for the Part_terminal_external_reference.

4.2.503.3 feature_type

The feature_type specifies the string that identifies the type of the terminal referenced for the Part_terminal_external_reference. The interpretation of this string by a receiving system shall be in accordance with the interpretation of Part_terminal.

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Constraints:

UR1: Each member of Part_terminal_external_reference shall have a unique combination of attributes.

WR1: The types of terminals are limited to those types defined in this part of ISO 10303.

WR2: If a Part_terminal type is specified for the feature_type, a Physical_unit type shall be specified. If a Part_terminal type is not specified for the feature_type, a Part_template type shall be specified for the associated_definition.

4.2.504 Part_text_template

A Part_text_template is a type of Part_template (see 4.2.498) that is the information required to support the creation of text messages in the stratum material on the Interconnect_module (see 4.2.372) or in a marking application.

The data associated with a Part_text_template are the following:

— font;

— maximum_font_horizontal_extent;

— maximum_font_vertical_extent;

— slant_angle;

— stroke_width.

4.2.504.1 font

The font specifies either the Font_definition (see 5.2.4.341) or the Registered_font (see 4.2.610) for the Part_text_template.

4.2.504.2 maximum_font_horizontal_extent

The maximum_font_horizontal_extent specifies the role of the Length_data_element (see 4.2.422) for the width of the Part_text_template.

4.2.504.3 maximum_font_vertical_extent

The maximum_font_vertical_extent specifies the role of the Length_data_element (see 4.2.422) for the height of the Part_text_template.

4.2.504.4 slant_angle

The slant_angle specifies the Angle_data_element that is the deviation from vertical for the Part_text_-template.

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4.2.504.5 stroke_width

The stroke_width specifies the Length_data_element that is the distance across a single line that draws the glyph for the Part_text_template.

NOTE A per character shape is required because the message is not available in the template definition. This limits the capability to support proportional font by causing the bounding box to be the maximum size required rather than the minimum that would occur if the bounding box were calculated strictly on the basis of the font proportions in the actual design.

Constraints:

WR1: font glyph shall not extend beyond the shape established by the template_shape.

4.2.505 Part_tooling_feature

A Part_tooling_feature is a type of Part_feature (see 4.2.494). A Part_tooling_feature may be a Fiducial_-part_feature (see 5.2.4.284). A Part_tooling_feature identifies a feature for tooling purposes. A feature may be used for other purposes or may intrinsically be in a particular feature category, and in either of those cases the feature would be a Part_tooling_feature and also the other type of feature.

EXAMPLE 1 Examples of a Part_tooling_feature include, but are not limited, to slots, passages, notches defined by Geometric Dimensioning and Tolerancing methodology, as well as fiducials.

4.2.506 Partially_plated_cutout

A Partially_plated_cutout is a type of Cutout (see 5.2.4.31) that is not a completely plated cutout for reason of manufacturing capabilities or design purposes.

The data associated with a Partially_plated_cutout are the following:

— plated_segment;

— unplated_segment.

4.2.506.1 plated_segment

A plated_segment is an inverse relationship that specifies that the existence of the Partially_plated_cutout is dependent on the existence of the Plated_cutout_edge_segment that specifies the Partially_plated_-cutout as a composed_cutout. There shall be one or more Plated_cutout_edge_segment (see 4.2.550) in the role of plated_segment for the Partially_plated_cutout. The plated_segment specifies the segment that is plated.

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4.2.506.2 unplated_segment

An unplated_segment is an inverse relationship that specifies that the existence of the Partially_plated_-cutout is dependent on the existence of the Cutout_edge_segment that specifies the Partially_plated_-cutout as a composed_cutout. There shall be one or more Cutout_edge_segment (see 5.2.4.27) in the role of unplated_segment for the Partially_plated_cutout. The unplated_segment specifies the segment that is unplated.

Constraints:

WR1: A Plated_cutout_segment shall not be in the role of unplated_segment.

4.2.507 Partially_plated_interconnect_module_edge

A Partially_plated_interconnect_module_edge is a type of Interconnect_module_edge (see 5.2.4.413) that is not a completely plated edge for reason of manufacturing capabilities or design purposes.

The data associated with a Partially_plated_interconnect_module_edge are the following:

— plated_segment;

— unplated_segment.

4.2.507.1 plated_segment

A plated_segment is an inverse relationship that specifies that the existence of the Partially_plated_-interconnect_module is dependent upon the existence of the Plated_interconnect_module_edge_segment that specifies the Partially_plated_interconnect_module_edge in the role of composed_edge. There shall be one or more Plated_interconnect_module_edge_segment (see 5.2.4.144) for the Partially_plated_-interconnect_module_edge.

4.2.507.2 unplated_segment

An unplated_segment is an inverse relationship that specifies that the existence of the Partially_plated_-interconnect_module is dependent upon the existence of the Interconnect_module_edge_segment that specifies the Partially_plated_interconnect_module_edge in the role of composed_edge. There shall be one or more Interconnect_module_edge_segment (see 5.2.4.421) for the Partially_plated_interconnect_-module_edge.

Constraints:

WR1: There shall be no Plated_interconnect_module_edge_segment in the role of unplated_segment for the Partially_plated_interconnect_module.

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4.2.508 Participant_date_and_time_assignment

A Participant_date_and_time_assignment is a type of Managed_design_object (see 4.2.431). A Participant_date_and_time_assignment is the relationship between a Person_and_organization (see 5.2.4.275) and a Date_and_time (see 4.2.175).

The data associated with a Participant_date_and_time_assignment are the following:

— action_date_and_time;

— action_participant.

4.2.508.1 action_date_and_time

The action_date_and_time specifies the role of the Date_and_time (see 4.2.175) for the Participant_date_and_time_assignment.

4.2.508.2 action_participant

The action_participant specifies the role of the Person_and_organization (see 5.2.4.275) for the Participant_date_and_time_assignment.

4.2.509 Passage_technology

A Passage_technology is a type of Managed_design_object (see 4.2.431). A Passage_technology may be either a Default_component_termination_passage_definition (see 5.2.4.111), a Default_unsupported_passage_definition (see 5.2.4.148), or a Default_via_definition (see 5.2.4.89). A Passage_technology specifies material properties and parametric data associated with a specific manufacturing process for identified material, where that material and manufacturing process has been selected for a specific design. A Passage_technology includes the material stackupt parametric data related to the design of the interconnect substrate associated with the Stratum the Passage_technology is related to through the as_finished_inter_stratum_extent attribute.

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The data associated with a Passage_technology are the following:

— as_finished_inter_stratum_extent;

— deposition_material;

— maximum_aspect_ratio;

— maximum_as_finished_deposition_thickness;

— maximum_as_finished_passage_extent;

— minimum_as_finished_deposition_thickness;

— minimum_as_finished_passage_extent;

— name;

— plated_passage;

— specification.

NOTE Passage_technology also supports substrate edges.

4.2.509.1 as_finished_inter_stratum_extent

The as_finished_inter_stratum_extent specifies the Inter_stratum_extent (see 5.2.4.83) that will be created for the Passage_technology. Material additions by plating or other means will extend the reach of the Inter_stratum_extent to the as-finished condition because these Stratum (see 4.2.677) are not present during the machining operation but are created during the finishing operations.

4.2.509.2 deposition_material

The deposition_material specifies the role of the Ee_material (see 4.2.273) that forms the vertical wall of a feature that uses the Passage_technology. The deposition_material need not be specified for a particular Passage_technology.

4.2.509.3 maximum_aspect_ratio

The maximum_aspect_ratio specifies the largest allowable ratio of passage length divided by passage diameter for the Passage_technology. The maximum_aspect_ratio need not be specified for a particular Passage_technology.

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NOTE The aspect ratio is a factor in determining the expected quality of the electroplating process in depositing metal in the passage. If the aspect ratio is large, meaning an extremely long passage in relation to its diameter, the deposition will be thinner in the central portion of the passage length than at each end of the passage. For this reason, a maximum_aspect_ratio is often determined as a factor in deciding upon the smallest passage diameters to be allowed in a PCB design. Thicker PCBs require larger minimum passage diameters, for the same expected plating quality.

4.2.509.4 maximum_as_finished_deposition_thickness

The maximum_as_finished_deposition_thickness specifies the Length_data_element (see 4.2.422) that is the upper bound of the thickness of the deposition metal in the passage by the Passage_technology.

NOTE Material deposition within a passage, by plating or other means, decreases the diameter of the passage. This attribute assists in providing the information required to select the correct tool for creating the passage before plating. The maximum deposition thickness results in the smallest passage diameter after finishing.

4.2.509.5 maximum_as_finished_passage_extent

The maximum_as_finished_passage_extent specifies the Length_data_element (see 4.2.422) of the upper bound of the diametrical extent after processing for the Passage_technology. A maximum_as_finished_-passage_extent need not be specified for a particular Passage_technology.

4.2.509.6 minimum_as_finished_deposition_thickness

The minimum_as_finished_deposition_thickness specifies the Length_data_element (see 4.2.422) of the lower bound of the thickness of deposited plating in the passage of a PCB for the Passage_technology. The minimum_as_finished_deposition_thickness need not be specified for a particular Passage_technology.

NOTE In order to help insure continuity of the deposited conductive material in a passage, and therefore to help insure connectivity between the plating in a passage and the lands of every Design_layer_stratum (see 5.2.4.382) that intersect that passage, a minimum plating thickness is specified. This plating thickness is usually verified in the fabrication process by including test coupons in the panel of PCBs being fabricated. These coupons include typically sized lands and passages as are found on the PCBs being fabricated; the coupons are removed from the panel during fabrication and metallurgical cross sections are created for process quality verification. These cross sections provide visibility of both the electroless and electrolytic plating process quality as well as the quality of the final tin-lead plating or coating of the passage walls as well as of the so-called knee area, where the passage wall intersects the lands at each end of the passage. Solderability of the tin-lead is partially a factor of the minimum plating thickness at the knee, since tin-lead solder and copper form a visible intermetallic structure when one dissolves into the other during the process of melting the solder. This visible intermetallic structure is brittle and is not indicative of a solder joint of high quality. There must be ample solder, in the bare PCB, over this intermetallic knee, in order to assist in providing a PCB that has good solderability to the assembly operation.

4.2.509.7 minimum_as_finished_passage_extent

The minimum_as_finished_passage_extent specifies the Length_data_element (see 4.2.422) of the lower bound of the diametrical extent for the Passage_technology. The minimum_as_finished_passage_extent need not be specified for a particular Passage_technology.

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4.2.509.8 name

The name identifies the Passage_technology.

4.2.509.9 plated_passage

The plated_passage specifies whether or not the deposition_material is added to the passage for the Passage_technology. The value of TRUE indicates that the material is added. The value of FALSE indicates that the material is not added.

NOTE 1 This boolean makes no reference to the process to be used for adding a tin-lead alloy or other solder to the conductive walls of the plated_passage. Some processes electroplate the tin-lead alloy and later melt, or reflow, the alloy to reduce its granular appearance; other processes coat the passage walls and other exposed conductive surfaces of the PCB with molten solder in a process called solder-coating. These processes are only applicable to plated_passages in the PCB.

NOTE 2 This part of ISO 10303 does not presume a Pcb (see 5.2.4.38) wet-chemistry only process, but allows for other processes of metallization of passage walls.

4.2.509.10 specification

The specifcation establishes the role of Process_specification for the Passage_technology. The specification need not be specified for a particular Passage_technology.

Constraints:

UR1: The name shall be unique within a population of Passage_technologies.

WR1: Each passage that is plated shall have deposition_material provided.

WR2: Each passage that has maximum_as_finished_deposition_thickness provided shall have deposition_material provided.

WR3: Each passage that has minimum_as_finished_deposition_thickness provided shall have deposition_material provided.

WR4: If plated_passage has a value of TRUE Passage_technology shall reference Material_conductivity_classification that equals "conductive".

4.2.510 Pca

A Pca is a type of Assembly_module (see 4.2.34). A Pca describes a printed circuit assembly. A printed circuit assembly is nearly a synonym for printed wiring assembly, except that a printed circuit assembly may include printed components in its printed circuit board and a printed wiring assembly is constructed upon a printed wiring board that is totally interconnect without printed components. Another synonym for printed circuit assembly is circuit card assembly.

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EXAMPLE 1 See figure 73 for an illustration of a Pca.

The data associated with a Pca are the following:

— usage_view.

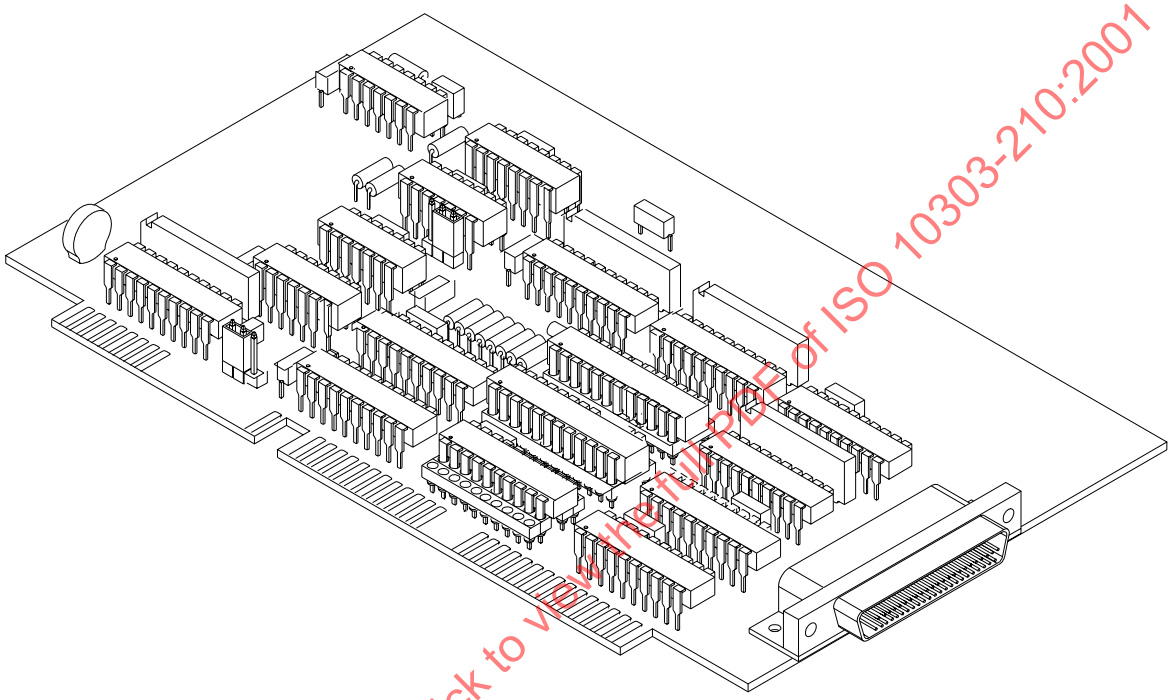

Figure 73 – Pca

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4.2.510.1 usage_view

The usage_view specifies the Pca_usage_view (see 4.2.512), as seen from the context of its next assembly, for the Pca.

4.2.511 Pca_terminal

A Pca_terminal is a type of Assembly_module_terminal (see 4.2.37) that is part of the interface between the Pca (see 4.2.510) and its next higher assembly.

The data associated with a Pca_terminal are the following:

— associated_definition.

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4.2.511.1 associated_definition

The associated_definition specifies the role of the Pca_usage_view (see 4.2.512) for the Pca_terminal.

4.2.512 Pca_usage_view

A Pca_usage_view is a type of Assembly_module_usage_view (see 4.2.38). A Pca_usage_view provides the information needed to include the Pca (see 4.2.510) in the design of the next higher level assembly, but not necessarily sufficient information to reproduce that Pca.

NOTE A Packaged_connector may be located in a usage view in addition to terminals. Reference Assembly_module_usage_view_connector_relationship (see 4.2.39)

EXAMPLE 1 Figure 74 illustrates details available in a usage view for a Pca. The information available in the usage view specifically is separate from that in the design view and the relationships between the two views are usually controlled by a design organization.

Constraints:

WR1: Each Pca_usage_view shall have at least two terminals.

4.2.513 Pcb

A Pcb is a type of Interconnect_module (see 4.2.372). A Pcb describes a printed circuit board. A printed circuit board is nearly a synonym for printed wiring board, except that a printed circuit board may include printed components and a printed wiring board is totally interconnected without printed components. This part of ISO 10303 supports the exchange of product categories in order to allow the exchange partners to differentiate between printed wiring board and printed circuit board.

EXAMPLE 1 Figure 77 illustrates a printed wiring board design.

EXAMPLE 2 Figures75 and76 illustrate complex printed wiring board mechanical designs that have functional shape requirements that are communicated using Geometric Dimensioning and Tolerancing information in a product model and not graphically.

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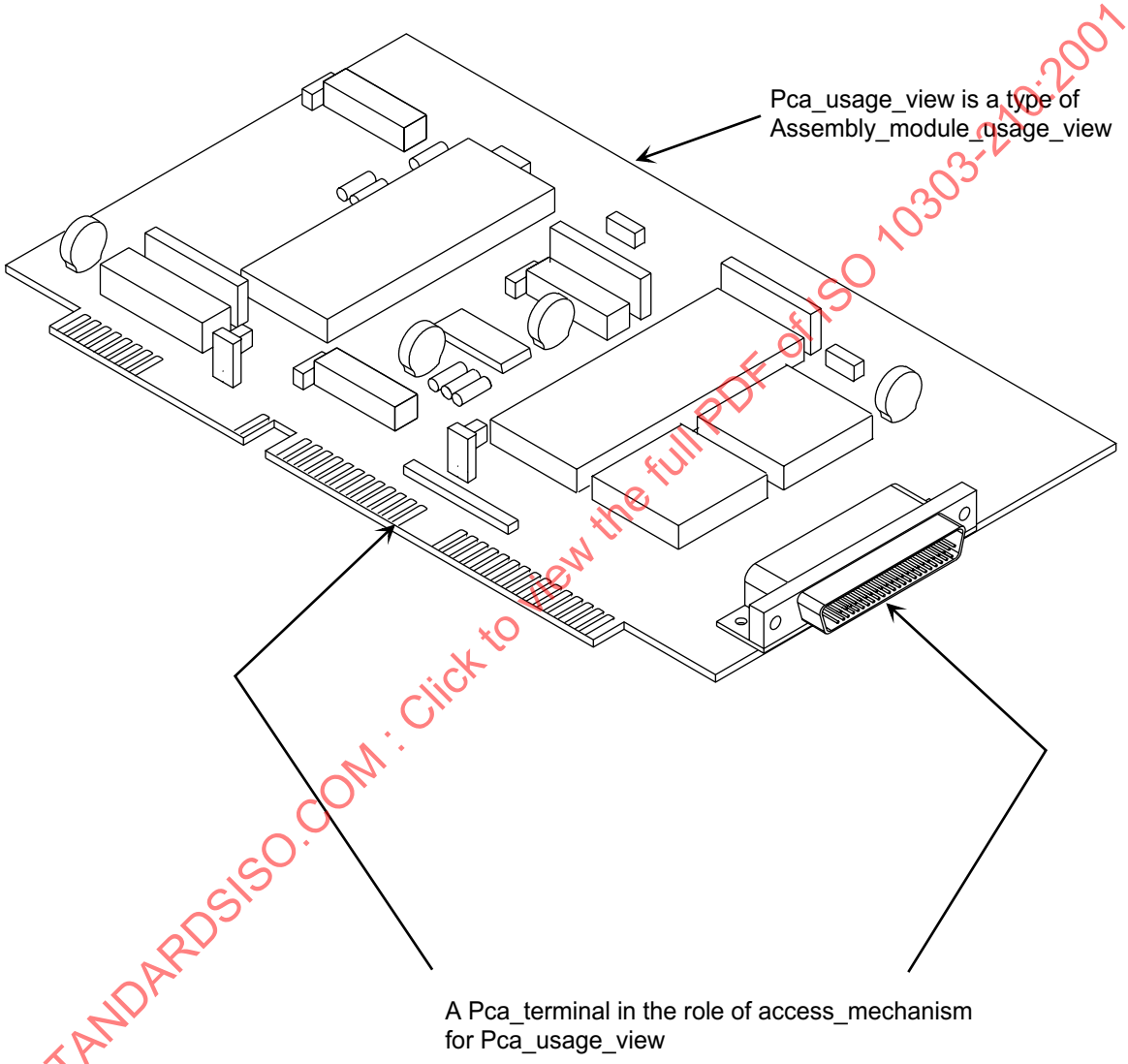

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Figure 74 – Pca_usage_view

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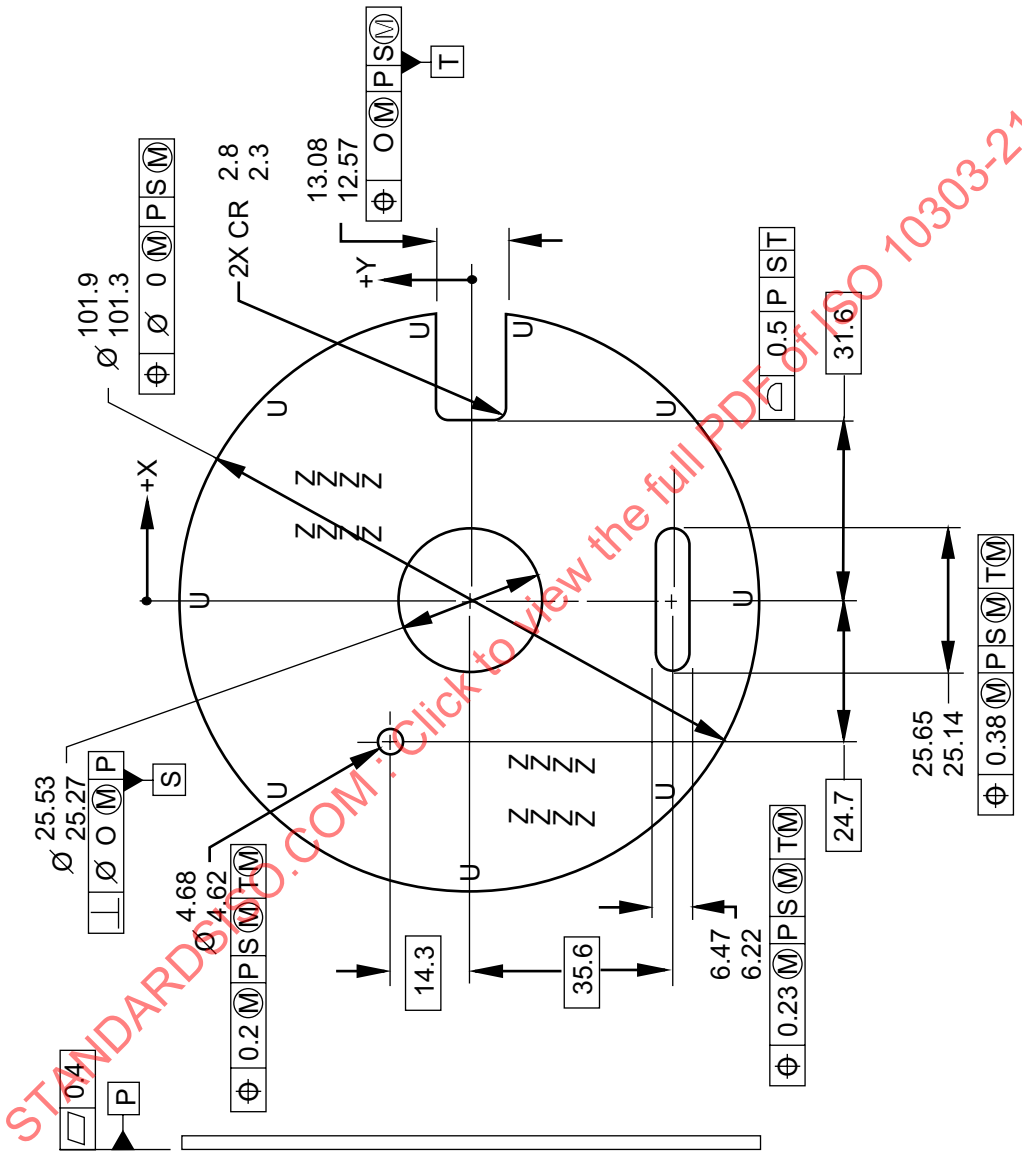

Figure 75 – Circular Pcb tolerances

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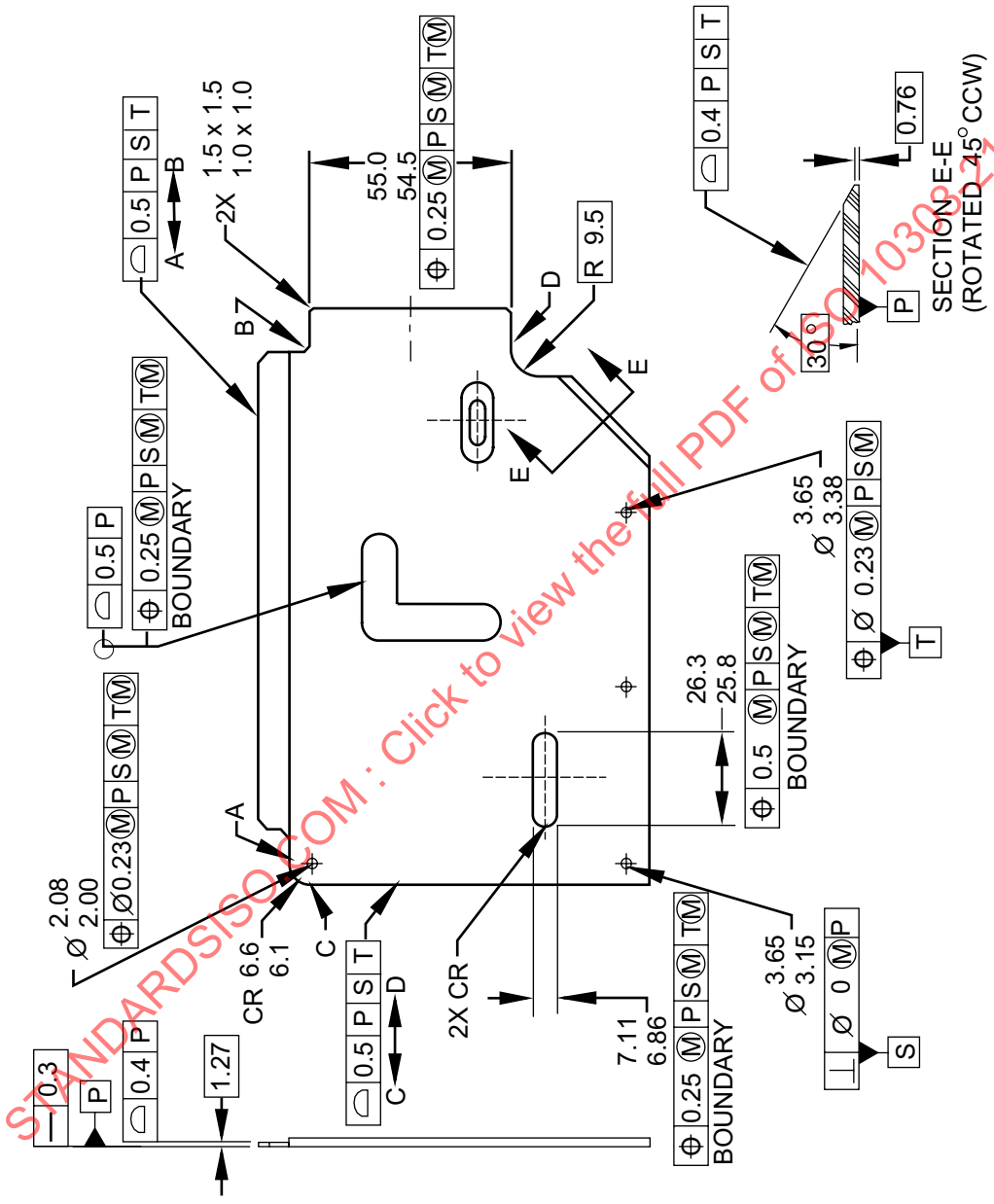

Figure 76 – Complex Pcb tolerances

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The data associated with a Pcb are the following:

— usage_view.

4.2.513.1 usage_view

The usage_view specifies the role of the Pcb_usage_view (see 5.2.4.188) for the Pcb.

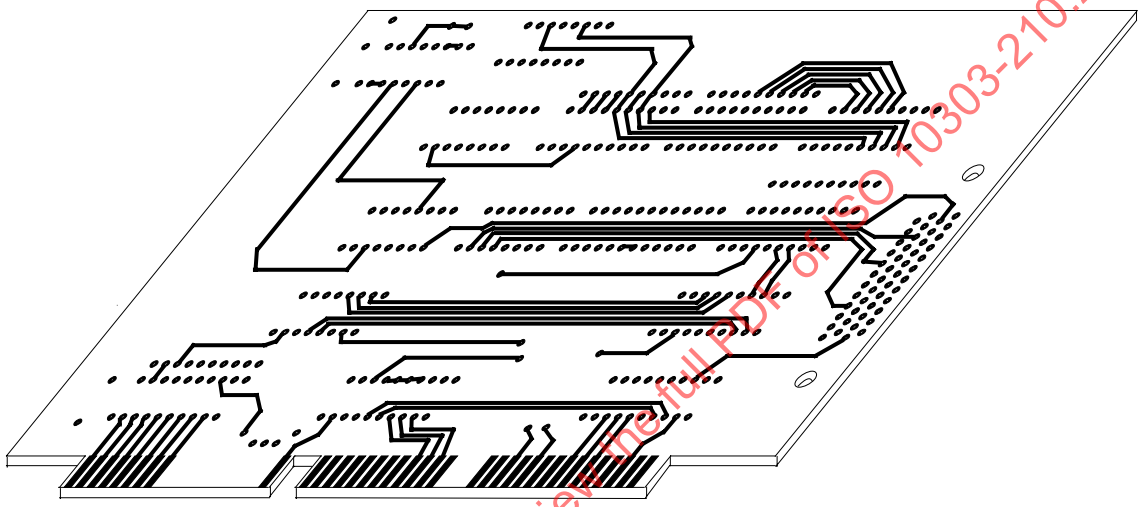

Figure 77 — Bare printed wiring board

4.2.514 Pcb_usage_view

A Pcb_usage_view is a type of Interconnect_module_usage_view (see 4.2.389) that provides the information necessary to include the Pcb (see 5.2.4.38) in its next higher level assembly for design and some simulation purposes, but may not include sufficient information to reproduce the Pcb.

EXAMPLE 1 Some of the information in figures75 and76 that communicate fit tolerances may be included in a usage view.

4.2.515 Perpendicular_shape_element_relationship

A Perpendicular_shape_element_relationship is a type of Shape_element_relationship (see 5.2.4.169) that asserts that two Shape_element (see 4.2.645) are perpendicular to each other. One Shape_element is specified as the related_shape_element and the other Shape_element is specified as the relating_shape_-element.

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NOTE 1 The attribute related_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

NOTE 2 The attribute relating_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

Constraints:

WR1: The Shape_element specified as the relating_shape_element shall not be specified as perpendicular to itself either directly of through intermediate Perpendicular_shape_element_relationship.

4.2.516 Perpendicularity_tolerance

A Perpendicularity_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on the perpendicularity of a Shape_element (see 4.2.645) in relation to one or two Datum (see 4.2.176).

NOTE Perpendicularity tolerance is defined in terms of tolerance zone definitions in 14.8 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Centre_axis, Centre_-plane, Physical_feature_or_part_template, or Tangent_plane.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: There shall be at most two Datum in the Datum_system the definition of which is specified as the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_-system entity of which this entity is a subtype.

WR3: At least one Datum_plane or Datum_axis shall be in the Datum_system the definition of which is specified as the datum_system_definition.

WR4: If the toleranced_shape_element is a Centre_plane, Physical_feature_or_part_template, or Tangent_plane, the Perpendicularity_tolerance shall specify a Tolerance_zone_definition as its tolerance_-zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_size.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a perpendicularity tolerance is sensible.

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4.2.517 Person

A Person is a type of Managed_design_object (see 4.2.431). A Person is an individual within the context of a single Organization (see 5.2.4.135).

The data associated with a Person are the following:

— address;

— identifier.

4.2.517.1 address

The address specifies the string for the interpretable name for the location of the Person. The address specifies the routing for postal mail or the physical location of the Person. The address need not be specified for a particular Person.

4.2.517.2 identifier

The identifier specifies the name that represents either the personal name or title of the Person.

4.2.518 Person_and_organization

A Person_and_organization is a type of Managed_design_object (see 4.2.431). A Person_and_organization is the aggregation of a Person (see 5.2.4.251) and an Organization (see 5.2.4.135).

The data associated with a Person_and_organization are the following:

— assigned_organization;

— assigned_person.

4.2.518.1 assigned_organization

The assigned_organization specifies the role of the Organization (see 5.2.4.135) for the Person_and_organization.

4.2.518.2 assigned_person

The assigned_person specifies the role of the Person (see 5.2.4.251) for the Person_and_organization.

Constraints:

UR1: The combination of the assigned_person and the assigned_organization shall be unique within a population of Person_and_organizations.

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4.2.519 Physical_component_feature

A Physical_component_feature is a type of Component_feature (see 4.2.90) and a type of Physical_-feature_or_part_template (see 4.2.527). The Physical_component_feature supports the specification of a Component_feature as a Datum_target or Datum_feature for the purpose of estabishing a Datum_-reference_frame for tolerance specification.

4.2.520 Physical_connectivity_abstraction_map

A Physical_connectivity_abstraction_map is a type of Managed_design_object (see 4.2.431) that provides traceability between a Physical_connectivity_element (see 4.2.523) and a Conductive_interconnect_element (see 5.2.4.154) for simulation or routing purposes.

The data associated with a Physical_connectivity_abstraction_map are the following:

— geometric_context_based_definition;

— name_space_context_based_definition.

4.2.520.1 geometric_context_based_definition

The geometric_context_based_definition specifies the role of the Conductive_interconnect_element (see 5.2.4.154) for the Physical_connectivity_abstraction_map.

4.2.520.2 name_space_context_based_definition

The name_space_context_based_definition specifies the role of the Physical_connectivity_element (see 4.2.523) for the Physical_connectivity_abstraction_map.

Constraints:

UR1: The combination of the geometric_context_based_definition and the name_space_context_based_-definition shall be unique within a population of Physical_connectivity_abstraction_maps.

4.2.521 Physical_connectivity_definition

A Physical_connectivity_definition is a type of Managed_design_object (see 4.2.431). A Physical_connectivity_definition may be a Physical_connectivity_structure_definition (see 5.2.4.147). A Physical_-connectivity_definition is the root node in the classification hierarchy of connectivity in the physical domain. All types of connectivity in this domain contain additional information to that of the base type. A Physical_connectivity_definition is a definition of one node, in an electrical network, consisting of physical terminals.

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The data associated with a Physical_connectivity_definition are the following:

— associated_terminals;

— name.

4.2.521.1 associated_terminals

The associated_terminals specify the Component_terminal (see 4.2.105) of the Physical_connectivity_definition. There shall be two or more Component_terminal for a Physical_connectivity_definition.

4.2.521.2 name

The name identifies the Physical_connectivity_definition.

Constraints:

UR1: The name shall be unique within a population of Physical_connectivity_definitions.

WR1: All associated_terminals shall be in the same design view.

4.2.522 Physical_connectivity_definition_relationship

A Physical_connectivity_definition_relationship is a type of Managed_design_object (see 4.2.431). A Physical_connectivity_definition_relationship is the association between Physical_connectivity_definition (see 5.2.4.1) that exists because of a Requirement_occurrence.

NOTE The purpose of the Physical_connectivity_definition_relationship is documented in the Requirement_occurrence, and is typically life cycle dependent, based on design iterations, or variations.

The data associated with a Physical_connectivity_definition_relationship are the following:

— current_definition;

— previous_definition;

— requirement.

4.2.522.1 current_definition

The current_definition specifies one role of the Physical_connectivity_definition (see 5.2.4.1) for the Physical_connectivity_definition_relationship.

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4.2.522.2 previous_definition

The previous_definition specifies one role of the Physical_connectivity_definition (see 5.2.4.1) for the Physical_connectivity_definition_relationship.

4.2.522.3 requirement

The requirement specifies the Ee_requirement_occurrence (see 4.2.283) that causes the Physical_connectivity_definition_relationship to be in existence between the current Physical_connectivity_definition (see 5.2.4.1) and the previous Physical_connectivity_definition.

4.2.523 Physical_connectivity_element

A Physical_connectivity_element is a type of Managed_design_object (see 4.2.431). A Physical_connectivity_element is the object that describes topological requirements for physical connectivity. A connectivity segment may be divided into one or more contiguous topological elements using the Physical_connectivity_element.

The data associated with a Physical_connectivity_element are the following:

— connectivity_context;

— end_terminus;

— name;

— start_terminus.

4.2.523.1 connectivity_context

The connectivity_context specifies the role of the Physical_connectivity_structure_definition (see 5.2.4.147) for the Physical_connectivity_element.

4.2.523.2 end_terminus

The end_terminus specifies either a Connectivity_sub_structure (see 5.2.4.283) or one of a Component_terminal (see 4.2.105) or a Topological_junction (see 5.2.4.205) as the end of the Physical_connectivity_element.

4.2.523.3 name

The name identifies the member of Physical_connectivity_element within the context of the assembly.

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4.2.523.4 start_terminus

The start_terminus specifies either a Connectivity_sub_structure (see 5.2.4.283) or one of a Component_terminal (see 4.2.105) or a Topological_junction (see 5.2.4.205) as the beginning of the Physical_connectivity_element.

Constraints:

UR1: The combination of the name and the connectivity_context shall be unique within a population of Physical_connectivity_element.

WR1: The start_terminus shall not be the end_terminus;

WR2: Each object referenced by the same member of Physical_connectivity_element shall be in the same design view.

4.2.524 Physical_connectivity_interrupting_cutout

A Physical_connectivity_interrupting_cutout is a type of Cutout (see 5.2.4.31) that is included in the design of an Interconnect_module (see 4.2.372) for the purpose of interrupting one or more connectivity_elements in an Interconnect_module.

NOTE A Physical_connectivity_interrupting_cutout is used where a relayout of the design that would remove the connectivity elements from the design is not provided, but where traceability to a Physical_connectivity_definition (see 5.2.4.1) is required.

The data associated with a Physical_connectivity_interrupting_cutout are the following:

— interrupted_connectivity_element.

4.2.524.1 interrupted_connectivity_element

The interrupted_connectivity_element specifies the Conductive_interconnect_element (see 5.2.4.154) that is interrupted with the Physical_connectivity_interrupting_cutout. There shall be one or more Conductive_interconnect_element for a Physical_connectivity_interrupting_cutout.

4.2.525 Physical_connectivity_make_from_relationship

A Physical_connectivity_make_from_relationship is a type of Managed_design_object (see 4.2.431). A Physical_connectivity_make_from_relationship is an association between one Physical_connectivity_definition (see 5.2.4.1) that is used as a basis for modification into another Physical_connectivity_definition and the modified Physical_connectivity_definition that results from the modification.

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The data associated with a Physical_connectivity_make_from_relationship are the following:

— resultant_definition;

— reusable_definition.

4.2.525.1 resultant_definition

The resultant_definition specifies the Physical_connectivity_definition (see 5.2.4.1) that results from modification of the reusable_definition of the Physical_connectivity_make_from_relationship.

4.2.525.2 reusable_definition

The reusable_definition specifies the Physical_connectivity_definition (see 5.2.4.1) for the basis for modification into the resultant_definition in the Physical_connectivity_make_from_relationship.

4.2.526 Physical_connectivity_structure_definition

A Physical_connectivity_structure_definition is a type of Physical_connectivity_definition (see 5.2.4.1) that has a structure. Structure included supports assignment of path based properties to a Physical_-connectivity_definition for routing or validation purposes.

The data associated with a Physical_connectivity_structure_definition are the following:

— structural_element.

4.2.526.1 structural_element

The structural_element is an inverse relationship that specifies that the existence of the Physical_connectivity_structure_definition is dependent on the existence of the Physical_connectivity_element (see 4.2.523) that specifies the Physical_connectivity_structural_definition as its connectivity_context. There shall be one or more Physical_connectivity_element for a Physical_connectivity_structural_definition.

4.2.527 Physical_feature_or_part_template

A Physical_feature_or_part_template is a type of Shape_element (see 4.2.645) that is either on the physical boundary of a Physical_unit (see 4.2.533) or is a Part_template (see 4.2.498). A Physical_feature_-or_part_template is one of an Inter_stratum_feature (see 4.2.364), a Part_feature (see 4.2.494), a Physical_component_feature (see 4.2.519), a Physical_laminate_component (see 5.2.4.262), a Part_template, or a Stratum_feature (see 4.2.683). Additionally, a Physical_feature_or_part_template may either be a Datum_feature (see 4.2.188) or a Datum_target (see 5.2.4.66). The Physical_feature_or_part_template is an intersection application object that supports assignemt of Geometric Dimensioning and Tolerance data to features or template definitions.

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Constraints:

IP1: If the Physical_feature_or_part_template is not a Part_template it shall be on the boundary of the Physical_unit.

4.2.528 Physical_laminate_component

A Physical_laminate_component is a type of Laminate_component (see 4.2.404) and a type of Physical_-feature_or_part_template (see 4.2.527). The Physical_laminate_component supports the specification of a Laminate_component as a Datum_target or Datum_feature for the purpose of estabishing a Datum_-reference_frame for tolerance specification.

4.2.529 Physical_network

A Physical_network is a type of Managed_design_object (see 4.2.431). A Physical_network is the result of mapping a topological definition of a physical connectivity requirement onto the conducting Design_layer_stratum (see 5.2.4.382) of an Interconnect_module (see 4.2.372). The vertices, specified by Component_terminal (see 4.2.105), are mapped onto Layer_connection_point (see 5.2.4.420) on the surface of one or more conducting Design_layer_stratum in the Interconnect_module. The design features that are implementing the Physical_network are accessed by traversing the structure specified by the interconnect_module_net_topology_element attribute. The Physical_network shall not implement direct connections to Component_terminal specified by Interface_mounted_join (see 5.2.4.208), or Assembly_joint (see 4.2.32), but shall implement connections only to Component_terminals in the scope of the design view being implemented. This Physical_network implements connectivity to the join terminals of the components that are interface components in this Interconnect_module, which is a design view. The scope of the Physical_network is entirely within the interconnect design view and provides no information about assembly connectivity of design views within which occurrences of the Interconnect_module, as Interconnect_module_component (see 4.2.373) may appear.

NOTE The Physical_node_requirement_to_implementing_component_allocation (see 5.2.4.209) application object is provided so that traceability of the required connectivity for an assembly design view to that implemented internally in an Interconnect_module may be supported. The Part_connected_terminals_definition (see 5.2.4.180) application object is provided to specify explicitly the external terminals of the interconnect substrate that are to be connected. In a case where a design organization re-uses an interconnect design, the Part_connected_terminals_-definition, since it is the actual connection statement for an Interconnect_module, defines the capabilities of the interconnect substrate to satisfy the requirements imposed by the Physical_node_requirement_to_implementing_-component_allocation object. There may be many sets of Physical_node_requirement_to_implementing_component_allocation (one set per assembly design) that reference an interconnect substrate. There is only one set of Part_connected_terminals_definition for an interconnect substrate.

The data associated with a Physical_network are the following:

— connectivity_requirement_element;

— interconnect_module_net_topology_element;

— name.

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4.2.529.1 connectivity_requirement_element

The connectivity_requirement_element specifies the Component_terminal (see 4.2.105) to be connected by the network described by the Physical_network. There shall be two or more Component_terminal for a Physical_network.

4.2.529.2 interconnect_module_net_topology_element

The interconnect_module_net_topology_element specifies the unique Join_relationship (see 5.2.4.34) that results from mapping the topological statement of the physical connectivity requirement onto the coordinate space of the conducting Design_layer_stratum (see 5.2.4.382) that compose the Interconnect_module (see 4.2.372). There shall be one or more Join_relationship for a Physical_network.

4.2.529.3 name

The name identifies the Physical_network.

Constraints:

UR1: The name shall be unique within a population of Physical_networks.

WR1: The Component_terminal specified by connectivity_requirement_element shall be one of the following:

Land_join_terminal,

Non_functional_land_join_terminal,

Printed_component_join_terminal,

Via_terminal,

Component_termination_passage_join_terminal.

WR2: All members of connectivity_requirement_element and interconnect_module_network_topology_element shall be in the same design view.

WR3: All Ee material that participates in the Physical_network shall have the same Material_conductivity_classification and shall be the same material.

WR4: Each member of Component_terminal in the role of connectivity_requirement_element and each member of Join_relationship in the role of interconnect_module_network_topology_element referenced by Physical_network shall be in the same design view or shall be an explicit external reference.

NOTE A Physical_network does not include connection requirements that are implemented by a Printed_component.

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4.2.530 Physical_network_supporting_inter_stratum_feature

A Physical_network_supporting_inter_stratum_feature is a type of Inter_stratum_join_implementation (see 5.2.4.22) and a type of Plated_inter_stratum_feature (see 5.2.4.422), that is included in the design for the purpose of implementing connectivity. A Physical_network_supporting_inter_stratum_feature references the Physical_network it is supporting through a relationship to the Join_relationship application object that it inherits from the Inter_stratum_join_implementation application object.

4.2.531 Physical_network_supporting_stratum_feature_conductive_join

A Physical_network_supporting_stratum_feature_conductive_join is a type of Inter_stratum_join_implementation (see 5.2.4.22) and a type of Stratum_feature_conductive_join (see 4.2.685), that is included in the design for the purpose of implementing a Physical_network. A Physical_network_supporting_stratum_feature_conductive_join effects an interconnection from a succeeding conductive material deposition to a preceding conductive material deposition for the purpose of implementing connectivity.

Constraints:

WR1: Each Stratum_feature interconnected shall be resident on a Stratum that is a resident stratum for a Layer_connection_point specified by the topological requirement that this implementation satisfies.

WR2: Each Stratum referenced by a Stratum_feature interconnected shall be disjoint from Stratum referenced by any other Stratum_feature interconnected.

4.2.532 Physical_node_requirement_to_implementing_component_allocation

A Physical_node_requirement_to_implementing_component_allocation is a type of Managed_design_object (see 4.2.431). A Physical_node_requirement_to_implementing_component_allocation is the association between the connectivity requirements and the component and joints that provide that connectivity. The component specified by implementation_component participate in an assembly relationship with the components whose terminals are specified by the physical_node_requirement in order for the total connectivity specified by physical_node_requirement to be achieved. There may be more than one member of physical_node_requirement_to_implementing_component for a member of Physical_connectivity_definition if the nodal implementation is split among more than one component.

NOTE The Physical_node_requirement_to_implementing_component_allocation is a link in the traceability path between the functional definition and the geometric representation of the interconnect substrate conductive patterns.

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The data associated with a Physical_node_requirement_to_implementing_component_allocation are the following:

— implementation_component;

— physical_node_requirement;

— implementation_interface_joint_set;

— implementation_joint_set.

4.2.532.1 implementation_component

The implementation_component specifies the role of the Assembly_component (see 4.2.27) for the Physical_node_requirement_to_implementing_component_allocation. The implementation_component is the component physically providing the implementation of connectivity stated by the requirements.

4.2.532.2 physical_node_requirement

The physical_node_requirement specifies the role of the Physical_connectivity_definition (see 5.2.4.1) for the Physical_node_requirement_to_implementing_component_allocation.

4.2.532.3 implementation_interface_joint_set

The implementation_interface_joint_set specifies the role of the Interface_mounted_join (see 5.2.4.208) for the Physical_node_requirement_to_implementing_component_allocation. The implementation_interface_joint_set identifies the joints that attach the terminals specified by the connectivity requirement to the interface features of the component that is implementing that requirement.

4.2.532.4 implementation_joint_set

The implementation_joint_set specifies the role of the Assembly_joint (see 4.2.32) for the Physical_node_requirement_to_implementing_component_allocation. The implementation_joint_set identifies the joints that attach the terminals specified by the connectivity requirement to the features of the component that is implementing that requirement. The implementation_joint_set identifies the joints that attach the terminals of interface components to the features of the component that is implementing that requirement.

Constraints:

WR1: The implementation_component, implementation_interface_joint_set, implementation_joint_set, and physical_node_requirement shall be in the same design view.

WR2: Either implementation_interface_joint_set shall be provided or implementation_joint_set shall be provided, but both shall not be provided.

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WR3: Each member of implementation_joint_set shall reference a feature of implementation_component in its set of assembly_features and shall reference a Component_terminal (see 4.2.105) that is also referenced by the attribute associated_terminals of the physical_node_requirement.

WR4: Each member of implementation_joint_set shall reference a feature of implementation_component in its set of assembly_features. Each member of implementation_joint_set shall either reference a Component_terminal (see 4.2.105) that is also referenced by the attribute associated_terminals of the physical_node_requirement, or shall reference a join terminal of the implementation_component referenced by another member of Physical_node_requirement_to_implementing_component_allocation where the interface terminal is referenced by implementation_interface_joint_set of that Physical_node_-requirement_to_implementing_component_allocation.

NOTE This rule reduces potential confusion caused by more than one implementation_component implementing a single binary connection between two terminals.

4.2.533 Physical_unit

A Physical_unit is a type of Ee_product_definition (see 5.2.4.143). Each Physical_unit is either a Physical_unit_design_view (see 4.2.535) or a Physical_unit_usage_view (see 4.2.538). A Physical_unit is the description of physical characteristics common to a variety of realizations of an Ee_product (see 4.2.274). This description is applicable to every occurrence of a physical realization in composing a higher level assembly.

The data associated with a Physical_unit are the following:

— analytical_physical_unit_representation;

— design_requirement;

— physical_device_characteristic;

— physical_device_coordinated_characteristic;

— unit_technology.

4.2.533.1 analytical_physical_unit_representation

The analytical_physical_unit_representation specifies the Analytical_representation (see 4.2.16) for the instance of a computer interpretable model (including assigned parameter values) of the Physical_unit. The analytical_physical_unit_representation need not be specified for a particular subtype of Physical_-unit. There may be more than one Analytical_representation for a Physical_unit.

NOTE Computer interpretable models are used to predict temperatures, stress, and failure rate. This is a representation because all declared parameters have values assigned so that when interpreted by a computer a report may be generated that describes the behaviour of the item represented. This report may be a graph or table.

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4.2.533.2 design_requirement

The design_requirement specifies the Ee_requirement_occurrence (see 4.2.283) for the technical requirement for the Physical_unit. The design_requirement need not be specified for a particular Physical_unit. There may be more than one Ee_requirement_occurrence for a Physical_unit.

4.2.533.3 physical_device_characteristic

The physical_device_characteristic specifies the role of the Characteristic (see 4.2.77) for the Physical_unit. The physical_device_characteristic need not be specified for a particular Physical_unit. There may be more than one Characteristic for a Physical_unit.

4.2.533.4 physical_device_coordinated_characteristic

The physical_device_coordinated_characteristic specifies the role of the Coordinated_characteristic (see 5.2.4.383) for the Physical_unit. The physical_device_coordinated_characteristic need not be specified for a particular Physical_unit. There may be more than one Coordinated_characteristic for a Physical_unit.

4.2.533.5 unit_technology

The unit_technology specifies the Technology (see 4.2.716) used to realize the Physical_unit. The unit_technology need not be specified for a particular Physical_unit.

EXAMPLE 1 Examples of the unit_technologies for the Physical_units that are Physical_unit_design_views called Interconnect_modules include rigid, flexible, and flex-rigid multilayer printed circuit boards, and three-dimensional Molded Interconnect Devices. Another categorization of such Physical_units includes digital, analogue, mixed, and rf technologies.

EXAMPLE 2 Some examples of the unit_technologies for Physical_units that are Physical_unit_usage_views called Packages include ceramic Dual Inline (DIP), plastic DIP, Single Inline (SIP), J-Lead, metal can, ball grid array, molded axial, and molded radial packages.

EXAMPLE 3 Examples of the unit_technologies for the Physical_units that are Physical_unit_usage_views called Bare_die include CMOS, ECL, GAAS, BICMOS.

EXAMPLE 4 Examples of the unit_technologies for the Physical_units that are Physical_unit_design_views called Assembly_modules are MCM-D (Multichip Modules, Deposited), MCM-L (Multichip Modules, Laminated), MCM-C (Multichip Modules, Ceramic), and hybrid microcircuits.

NOTE For interoperability purposes, the technology data also may be included in a more generic manner in Ee_product_category.

4.2.534 Physical_unit_3d_shape

A Physical_unit_3d_shape is a type of Managed_design_object (see 4.2.431). A Physical_unit_3d_shape is the shape in three orthogonal dimensions of a Physical_unit (see 4.2.533).

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The data associated with a Physical_unit_3d_shape are the following:

— application_technology_constraint;

— centroid_location;

— shape_characterized_physical_unit;

— shape_environment;

— shape_material_condition;

— shape_purpose;

— shape_representation.

4.2.534.1 application_technology_constraint

The application_technology_constraint specifies the role of Ee_requirement_occurrence for the Physical_unit_3d_shape. The application_technology_constraint is the relationship between physical shapes amd process constraints.

EXAMPLE 1 An example of an application_technology_constraint is the relationship of the shape of a clearance area to an assembly or testing process which requires the clearance.

4.2.534.2 centroid_location

The centroid_location is a Cartesian_point (see 4.2.67) which is the center of a Physical_unit_3d_shape. A centroid_location need not be specified for a particular Physical_unit_3d_shape.

4.2.534.3 shape_characterized_physical_unit

The shape_characterized_physical_unit specifies the role of the Physical_unit (see 4.2.533) for the Physical_unit_3d_shape.

4.2.534.4 shape_environment

The shape_environment specifies either manufacturing or an end_user_application as the environment for the Physical_unit_3d_shape.

4.2.534.5 shape_material_condition

The shape_material_condition specifies either the maximum_material_condition, the minimum_material_condition, or the nominal_material_condition as the material condition for the Physical_unit_3d_-shape.

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4.2.534.6 shape_purpose

The shape_purpose specifies either a design, a design_profile, a design_profile_above_seating_plane, a design_profile_below_seating_plane, an electro_magnetic_compatibility_analysis, a shock_analysis, a thermal_analysis, or a vibration_analysis as the purpose for the Physical_unit_3d_shape.

4.2.534.7 shape_representation

The shape_representation specifies the role of the Bound_volume_shape (see 4.2.58) for the Physical_-unit_3d_shape.

4.2.535 Physical_unit_design_view

A Physical_unit_design_view is a type of Physical_unit (see 4.2.533). A Physical_unit_design_view may be one or both of an Assembly_module (see 4.2.34) or an Interconnect_module (see 4.2.372). A Physical_unit_design_view shall fully describe a specifically designed item in sufficient detail to permit production of that item in a manufacturing process and analysis of that item's response to a simulated environment in a computer based experimental environment.

EXAMPLE 1 Figure 78 illustrates an assembly design view.

The data associated with a Physical_unit_design_view are the following:

— usage_view.

4.2.535.1 usage_view

The usage_view specifies the role of the Physical_unit_usage_view (see 4.2.538) for the Physical_unit_-design_view. The usage_view provides sufficient detail to allow the Physical_unit (see 4.2.533) to be utilized in its next assembly, but does not provide sufficient detail to allow reproduction of the Physical_unit. The usage_view specifies the features visible in the next assembly and the terminals of the Physical_unit, if there are any.

4.2.536 Physical_unit_planar_shape

A Physical_unit_planar_shape is a type of Managed_design_object (see 4.2.431). A Physical_unit_-planar_shape is the projected shape of the Physical_unit (see 4.2.533) in two dimensions.

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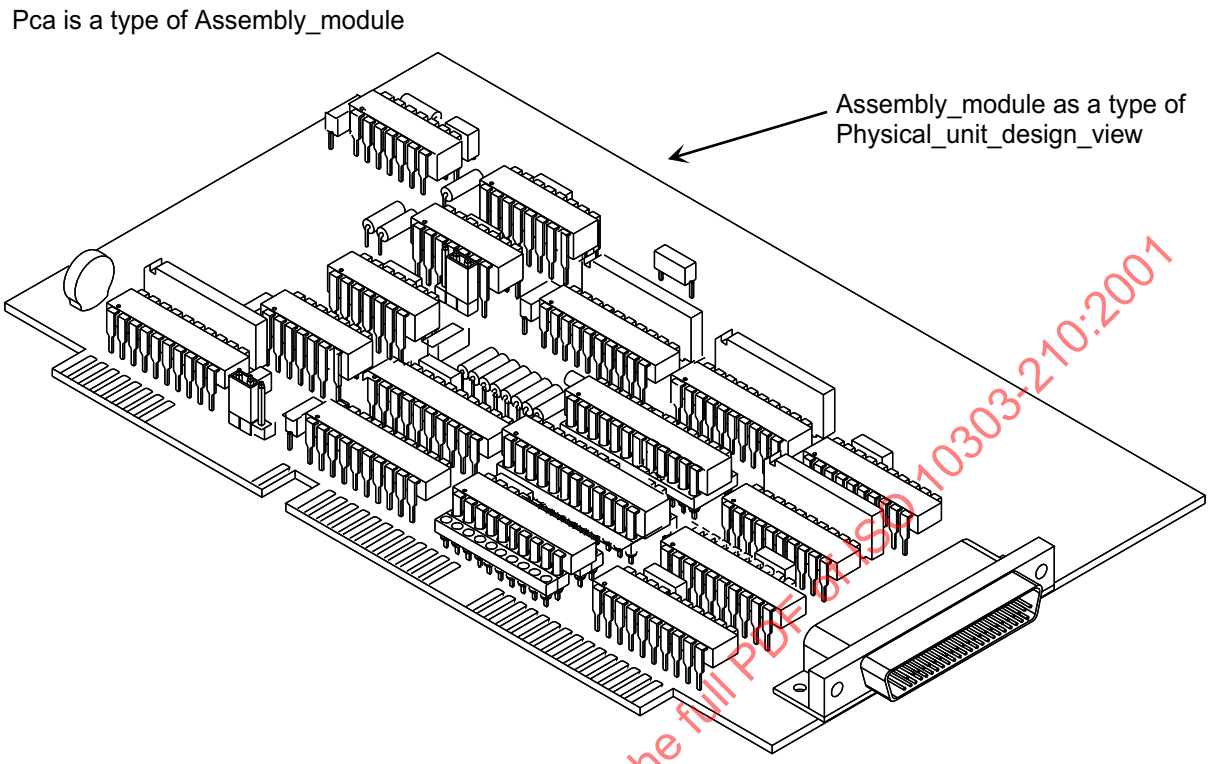

Figure 78 – Physical_unit_design_view

The data associated with a Physical_unit_planar_shape are the following:

— application_technology_constraint;

— centroid_location;

— shape_characterized_physical_unit;

— shape_environment;

— shape_material_condition;

— shape_purpose;

— shape_representation.

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4.2.536.1 application_technology_constraint

The application_technology_constraint specifies the role of Ee_requirement_occurrence for the Physical_unit_3d_shape. The application_technology_constraint is the relationship between physical shapes and process constraints.

EXAMPLE 1 An example of an application_technology_constraint is the relationship of the shape of a clearance area to an assembly or testing process which requires the clearance.

4.2.536.2 centroid_location

The centroid_location is a Cartesian_point (see 4.2.67) which is the center of a Physical_unit_planar_shape. A centroid_location need not be specified for a particular Physical_unit_planar_shape.

4.2.536.3 shape_characterized_physical_unit

The shape_characterized_part_unit specifies the role of the Physical_unit (see 4.2.533) for the Physical_unit_planar_shape.

4.2.536.4 shape_environment

The shape_environment specifies either manufacturing or an end_user_application as the environment for the Physical_unit_planar_shape.

4.2.536.5 shape_material_condition

The shape_material_condition specifies either the maximum_material_condition, the minimum_material_condition, or the nominal_material_condition as the material condition for the Physical_unit_planar_shape.

4.2.536.6 shape_purpose

The shape_purpose specifies either a design, a design_profile, a design_profile_above_seating_plane, a design_profile_below_seating_plane, an electro_magnetic_compatibility_analysis, a shock_analysis, a thermal_analysis, or a vibration_analysis, as the purpose for the Physical_unit_planar_shape.

4.2.536.7 shape_representation

The shape_representation specifies the role of the Planar_projected_shape (see 5.2.4.45) for the Physical_unit_planar_shape.

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Constraints:

WR1: If the shape_characterized_physical_unit attribute specifies a Bare_die, Package, or Packaged_part and the shape_environment is equal to "manufacturing" and the shape_purpose is equal to "design" then the planar shape shall be oriented parallel to the seating plane and the distance to the seating plane shall be greater than any point in the volume of the Physical_unit.

NOTE This rule provides a shape representation useful for the top view of an item as may be seen in an assembly.

4.2.537 Physical_unit_relationship

A Physical_unit_relationship is a type of Managed_design_object (see 4.2.431). A Physical_unit_relationship is the association of two Physical_unit (see 4.2.533).

The data associated with a Physical_unit_relationship are the following:

— related_unit;

— relating_unit.

4.2.537.1 related_unit

The related_unit specifies the dependent Physical_unit (see 4.2.533) that is related to the independent Physical_unit in a Physical_unit_relationship.

4.2.537.2 relating_unit

The relating_unit specifies the independent Physical_unit (see 4.2.533) to which the Physical_unit_relationship is made.

4.2.538 Physical_unit_usage_view

A Physical_unit_usage_view is a type of Physical_unit (see 4.2.533). Each Physical_unit_usage_view may be one of an Assembly_module_usage_view (see 4.2.38), a Bare_die (see 4.2.47), an Interconnect_module_usage_view (see 4.2.389), a Package (see 4.2.466), or a Packaged_part (see 4.2.481). A Physical_unit_usage_view identifies a Physical_unit as a part in its next assembly with sufficient detail to allow its use but without sufficient detail to permit reproduction of the Physical_unit. The product version referenced by the version attribute inherited from Ee_product_definition need not reference the same product version referenced by the design view.

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NOTE 1 The product information necessary for a Physical_unit_usage_view is much less than that necessary to design, manufacture, or verify its performance from first principles. Terminals are defined only in the usage view of an item in this part of ISO 10303.

NOTE 2 The usage view and design view of product contain similar concepts. It is the responsibility of the design organization to create the mapping between the usage view and the design view. As the design evolves to meet the requirements, the design view will reference different versions than the usage view.

NOTE 3 In a drawing based exchange, an interface control drawing would contain the same information found in a usage view. Industry standards describing the information represented by interface control drawings could migrate to computer interpetable standards exchange using this standard.

EXAMPLE 1 Examples of information provided in a usage view include outline shape, functional block diagram, terminal identification, package orientation features, mounting features, interface models, pin mapping.

The data associated with a Physical_unit_usage_view are the following:

— approved_part;

— material.

4.2.538.1 approved_part

The approved_part specifies the Supplied_product_version (see 4.2.709) that satisfies the intended application of a certain Physical_unit_usage_view. The approved_part need not be specified for a particular Physical_unit_usage_view. There may be more than one Supplied_product_version for a Physical_unit_usage_view.

4.2.538.2 material

The material specifies the Ee_material (see 4.2.273) used to manufacture the Physical_unit_usage_view. There may be more than one material for a Physical_unit_usage_view. The material need not be specified for a particular Physical_unit_usage_view.

4.2.539 Placement_group

A Placement_group is a type of Managed_design_object (see 4.2.431). A Placement_group is a group composed of Assembly_component (see 4.2.27) that are associated with each other for this purpose by the Component_group_assignment (see 4.2.96), in order to meet some specific placement requirement. The placement is assigned through the Placement_group_area_assignment (see 5.2.4.320) object, and does not indicate the explicit geometric relationship of the Assembly_components to each other, only that they are all to be placed within an area.

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EXAMPLE 1 An example of a Placement_group is the collection of Assembly_components necessary to satisfy the functional requirement for a power supply.

EXAMPLE 2 An example of a Placement_group is the collection of Assembly_components necessary to satisfy the functional requirement for a digital signal processor.

EXAMPLE 3 An example of a Placement_group is the collection of Assembly_components with a case temperature greater than 55 degrees Centigrade. The associated area would be a rectangle all of whose inner points are within 6 cm of the cooling unit.

The data associated with a Placement_group are the following:

— design_specific_usage;

— requirement.

4.2.539.1 design_specific_usage

The design_specific_usage specifies the name of the Placement_group.

EXAMPLE 1 Examples of design_specific_usage include analogue input buffer, preprocessor, emi filter, video multiplexor, and high speed digital.

4.2.539.2 requirement

The requirement specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Placement_group. There shall be one or more Ee_requirement_occurrence for a Placement_group.

4.2.540 Placement_group_area_assignment

A Placement_group_area_assignment is a type of Managed_design_object (see 4.2.431). A Placement_group_area_assignment is the relationship between a Placement_group (see 4.2.539) and the Mounting_restriction_area (see 5.2.4.14) on the interconnect substrate instance to which it is restricted.

The data associated with a Placement_group_area_assignment are the following:

— area;

— placed_group.

4.2.540.1 area

The area specifies the role of the Mounting_restriction_area (see 5.2.4.14) for the Placement_group_area_assignment.

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4.2.540.2 placed_group

The placed_group specifies the role of the Placement_group (see 4.2.539) for the Placement_group_-area_assignment.

4.2.541 Planar_projected_shape

A Planar_projected_shape is a type of Planar_shape (see 5.2.4.231) that is projected from a solid.

The data associated with a Planar_projected_shape are the following:

— curve_basis.

4.2.541.1 curve_basis

The curve_basis is an inverse relationship that specifies Volume_shape_projection (see 4.2.772) that specifies the Planar_projected_shape as its surface_projection. There shall be no more than one Volume_-shape_projection for a Planar_projected_shape.

4.2.542 Planar_shape

A Planar_shape is a type of Feature_shape_definition (see 4.2.315) that lies on a two-dimensional plane. A Planar_shape may be either one of or both an Edge_shape (see 4.2.268) or a Planar_projected_shape (see 5.2.4.45).

4.2.543 Planned_characteristic

A Planned_characteristic is a type of Managed_design_object (see 4.2.431). A Planned_characteristic associates design intent information based on manufacturing capabilities and component characteristics with an allocated requirement. A Planned_characteristic is a set of properties planned to be valid for all occurrences of the designed product under the conditions defined in the allocated requirement.

The data associated with a Planned_characteristic are the following:

— planned_coordinated_characteristic;

— reference_requirement.

4.2.543.1 planned_coordinated_characteristic

The planned_coordinated_characteristic specifies the role of the Coordinated_characteristic (see 5.2.4.383) for the Planned_characteristic.

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4.2.543.2 reference_requirement

The reference_requirement specifies the Assembly_requirement_allocation (see 4.2.40), Functional_-unit_requirement_allocation (see 5.2.4.272), or the Requirement_allocation (see 4.2.613) for the Planned_-characteristic.

NOTE This information is part of the design view for archival purposes of the design organization.

4.2.544 Planned_date_effectivity

A Planned_date_effectivity is a type of Planned_effectivity (see 4.2.545). A Planned_date_effectivity is the specification by the design organization of the intended use of an Ee_product (see 4.2.274) or of an Ee_product within an Ee_product_configuration (see 5.2.4.395), determined by one or two dates.

The data associated with a Planned_date_effectivity are the following:

— end_date;

— start_date.

4.2.544.1 end_date

The end_date specifies either the final Date (see 4.2.174) or the final Date_and_time (see 4.2.175) upon which the Ee_product (see 4.2.274) is planned by a design organization to be used in the Ee_product_-configuration (see 5.2.4.395), as defined by the Planned_date_effectivity. The end_date need not be specified for a particular Planned_date_effectivity.

4.2.544.2 start_date

The start_date specifies either the initial Date (see 4.2.174) or the initial Date_and_time (see 4.2.175); upon which the Ee_product (see 4.2.274) is planned by a design organization to be used in the Ee_-product_configuration (see 5.2.4.395), as defined by the Planned_date_effectivity.

4.2.545 Planned_effectivity

A Planned_effectivity is a type of Managed_design_object (see 4.2.431). A Planned_effectivity may be a Planned_date_effectivity (see 4.2.544), Planned_lot_effectivity (see 4.2.546), or Planned_serial_-number_effectivity (see 4.2.547). A Planned_effectivity is the specification by a design organization of the intended use of an Ee_product (see 4.2.274) or of an Ee_product within a particular Ee_product_-configuration (see 5.2.4.395). The Planned_effectivity details the circumstances under which the usage will take place.

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The data associated with a Planned_effectivity are the following:

— component_quantity;

— configuration;

— effective_assembly;

— effectivity_approval.

4.2.545.1 component_quantity

The component_quantity specifies the number of parts as a Data_element (see 4.2.173) that are included in the affected Ee_product_configuration (see 5.2.4.395). The component_quantity need not be specified for a particular Planned_effectivity.

4.2.545.2 configuration

The configuration specifies the Ee_product_configuration (see 5.2.4.395) that is effected by the Planned_-effectivity.

4.2.545.3 effective_assembly

The effective_assembly specifies the role of the Assembly_composition_relationship (see 4.2.30) for the Planned_effectivity.

4.2.545.4 effectivity_approval

The effectivity_approval specifies the Ee_approval (see 4.2.269) that is associated with the Ee_product (see 4.2.274) changes having the Planned_effectivity.

Constraints:

UR1: The combination of the configuration and the effective_assembly shall be unique within a population of Planned_effectivities.

WR1: The component_quantity, if it exists, shall be an integer greater than zero.

4.2.546 Planned_lot_effectivity

A Planned_lot_effectivity is a type of Planned_effectivity (see 4.2.545). A Planned_lot_effectivity is the specification by the design organization of the intended use of an Ee_product (see 4.2.274) or of an Ee_-product within an Ee_product_configuration (see 5.2.4.395), where the Ee_product or the Ee_product within an Ee_product_configuration is produced as one of a group or lot.

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The data associated with a Planned_lot_effectivity are the following:

— lot_number;

— lot_size.

4.2.546.1 lot_number

The lot_number specifies the string for the alphanumeric identification of the group of Ee_product (see 4.2.274) that compose a lot for the Planned_lot_effectivity.

4.2.546.2 lot_size

The lot_size specifies the quantity of Ee_product (see 4.2.274) as a Data_element (see 4.2.173) within the lot with the Planned_lot_effectivity.

Constraints:

WR1: The lot_size shall be an integer greater than zero.

4.2.547 Planned_serial_number_effectivity

A Planned_serial_number_effectivity is a type of Planned_effectivity (see 4.2.545). A Planned_serial_-number_effectivity is the specification by the design organization of the intended use of an Ee_product (see 4.2.274) identified by a range of serial numbers or of an Ee_product within Ee_product_configuration (see 5.2.4.395) identified by a range of serial numbers.

The data associated with a Planned_serial_number_effectivity are the following:

— from_effectivity_id;

— through_effectivity_id.

4.2.547.1 from_effectivity_id

The from_effectivity_id specifies the string for the initial serial number of the range of serial numbers for the Planned_serial_number_effectivity.

4.2.547.2 through_effectivity_id

The through_effectivity_id specifies the string for the final serial number of the range of serial numbers for the Planned_serial_number_effectivity. The through_effectivity_id need not be specified for a particular Planned_serial_number_effectivity.

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4.2.548 Plated_conductive_base_blind_via

A Plated_conductive_base_blind_via is a type of Blind_via (see 4.2.53) in which the material that composes the floor of the Blind_via is conductive, and in which the floor material of the Blind_via is contiguous with the material on the wall of the Blind_via. The process that is to create this conductive contiguous material is electroplating or similar.

4.2.549 Plated_cutout

A Plated_cutout is a type of Plated_inter_stratum_feature (see 5.2.4.422). The Plated_cutout is an interior volume of the substrate, such as a void included for passage of a shaft, and may be plated for EMI shielding purposes. This object conveys the semantic that the interior referenced by the related shape is conductive.

Constraints:

WR1: Each member of Plated_cutout shall not form part of the outer periphery of the Interconnect_module.

4.2.550 Plated_cutout_edge_segment

A Plated_cutout_edge_segment is a type of Plated_inter_stratum_feature (see 5.2.4.422) that helps compose a Partially_plated_cutout (see 4.2.506). The Plated_cutout_edge_segment is a feature with a specified shape that makes up part of the edge of a Partially_plated_cutout.

The data associated with a Plated_cutout_edge_segment are the following:

— composed_cutout;

— end_vertex;

— start_vertex.

4.2.550.1 composed_cutout

The composed_cutout specifies the Partially_plated_cutout (see 4.2.506) for whose edge this Plated_cutout_edge_segment is a segment.

4.2.550.2 end_vertex

The end_vertex specifies one role of an Edge_segment_vertex for the Plated_cutout_edge_segment.

4.2.550.3 start_vertex

The start_vertex specifies one role of an Edge_segment_vertex for the Plated_cutout_edge_segment.

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Constraints:

WR1: The start_vertex shall not be the end_vertex.

4.2.551 Plated_inter_stratum_feature

A Plated_inter_stratum_feature is a type of Inter_stratum_feature (see 4.2.364) with deposited metal on its walls that makes an electrical connection between conductive patterns on internal Design_layer_stratum (see 5.2.4.382), external Design_layer_stratum, or both, of a printed circuit board. A Plated_inter_stratum_feature is one of a Plated_cutout (see 4.2.549), a Plated_cutout_edge_segment (see 4.2.550), a Plated_interconnect_module_edge (see 4.2.552), a Plated_interconnect_module_edge_segment (see 5.2.4.144), or a Plated_passage (see 5.2.4.360), or additionally may be a Physical_network_supporting_inter_stratum_feature (see 5.2.4.30).

NOTE 1 A cross-section illustration of Plated_inter_stratum_feature that is the result of a wet chemistry process is shown in figure 79. An expanded view of one section of the feature is shown in figure 80.

NOTE 2 Plated_inter_stratum_features that completely pass through the PCB are sometimes known as plated through holes.

NOTE 3 Plated_inter_stratum_features are features that may be custom designed for this design by creating custom Inter_stratum_feature_template (see 5.2.4.76) shapes.

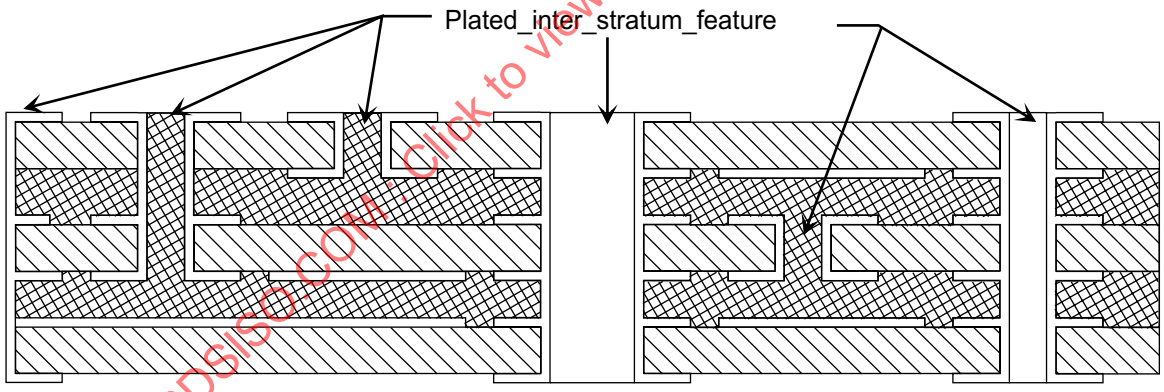

Figure 79 – Plated_inter_stratum_feature cross-section

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Constraints:

WR1: Each Plated_inter_stratum_feature shall reference a Passage_technology that has the attribute plated_passage set to TRUE.

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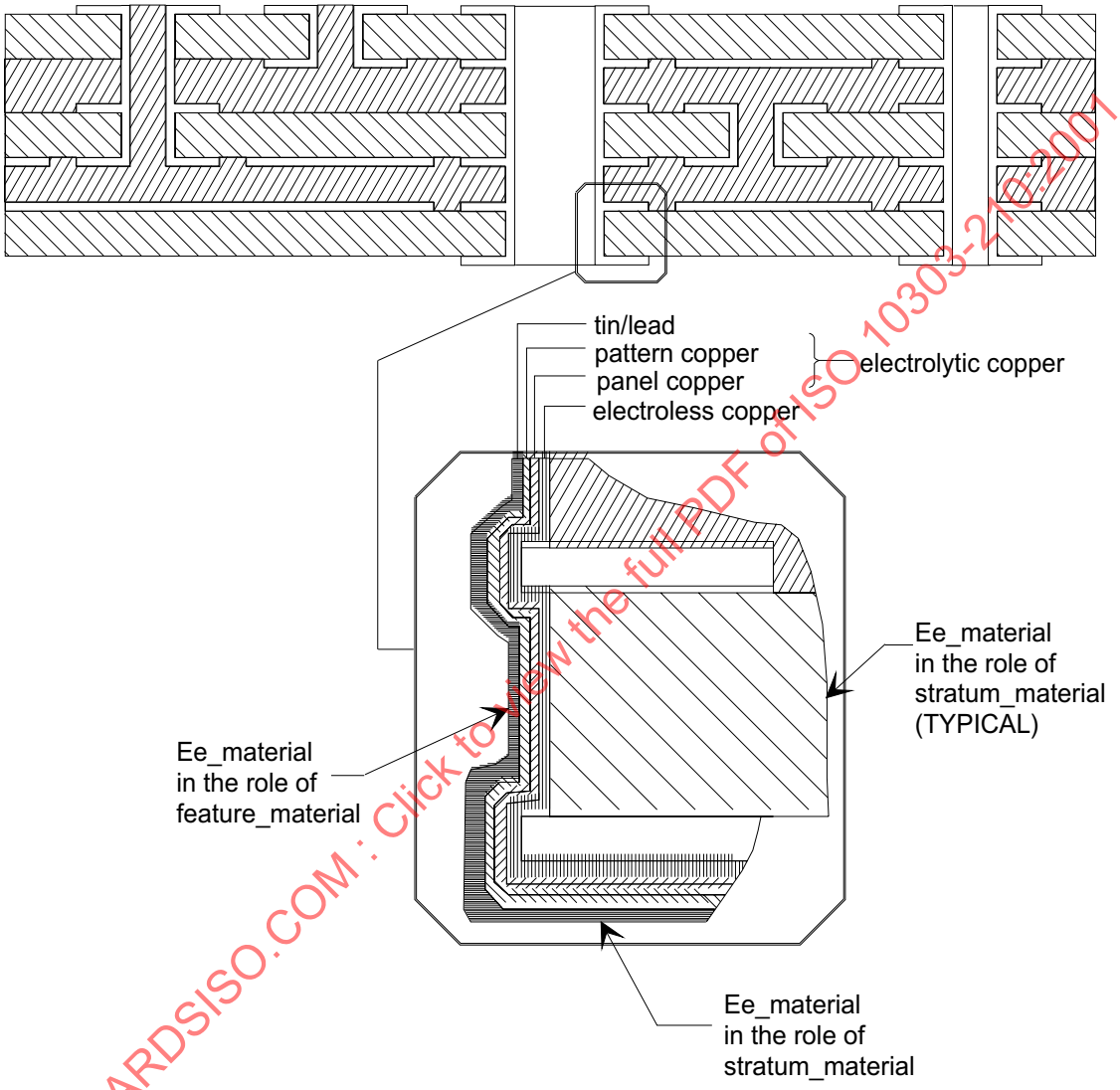

The Ee_material in the role of feature_material for a Plated_inter_stratum_feature is contiguous with the Ee_material in the role of stratum_material for a Stratum_technology, when the values of both Ee_material are identical.

Figure 80 – Exploded view of Plated_inter_stratum_feature

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4.2.552 Plated_interconnect_module_edge

A Plated_interconnect_module_edge is a type of Plated_inter_stratum_feature (see 5.2.4.422) that forms one of the edges of an interconnect substrate.

Constraints:

WR1: Each member of Plated_interconnect_module_edge shall only form the outer periphery of the Interconnect_module.

4.2.553 Plated_interconnect_module_edge_segment

A Plated_interconnect_module_edge_segment is a type of Plated_inter_stratum_feature (see 5.2.4.422) that forms a section of the edge of an interconnect substrate.

EXAMPLE 1 Figure 81 illustrates an edge segment that is plated. Note that the opposite side of the cross-section is unplated. There is not enough information in the figure to define the extent of the plated segment.

The data associated with a Plated_interconnect_module_edge_segment are the following:

— composed_edge;

— end_vertex;

— start_vertex.

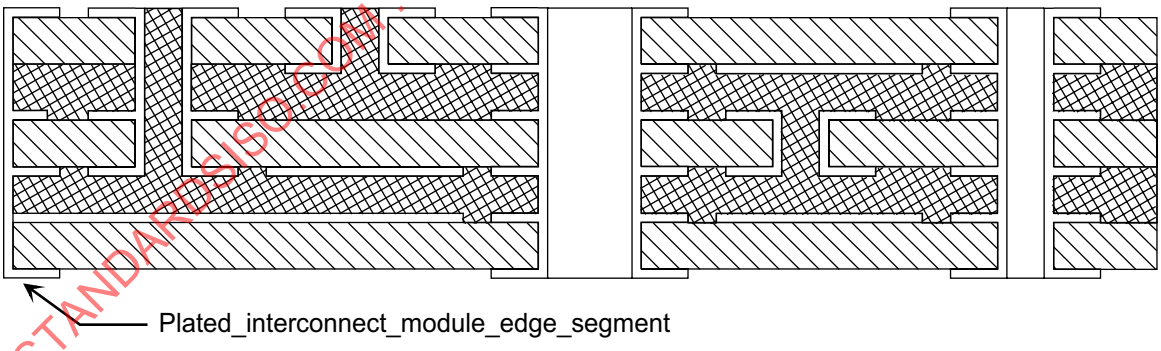

Figure 81 – Plated_interconnect_module_edge_segment

4.2.553.1 composed_edge

The composed_edge specifies the Partially_plated_interconnect_module_edge (see 4.2.507) that contains the Plated_interconnect_module_edge_segment.

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4.2.553.2 end_vertex

The end_vertex specifies one role of an Edge_segment_vertex for the Plated_interconnect_module_-edge_segment.

4.2.553.3 start_vertex

The start_vertex specifies one role of an Edge_segment_vertex for the Plated_interconnect_module_-edge_segment.

Constraints:

WR1: The start_vertex shall not be the end_vertex.

4.2.554 Plated_passage

A Plated_passage is a type of Plated_inter_stratum_feature (see 5.2.4.422). A Plated_passage is either a Component_termination_passage (see 5.2.4.227) or a Via (see 4.2.761).

EXAMPLE 1 Figure 82 graphically collects the various types of plated passages into a more generic category.

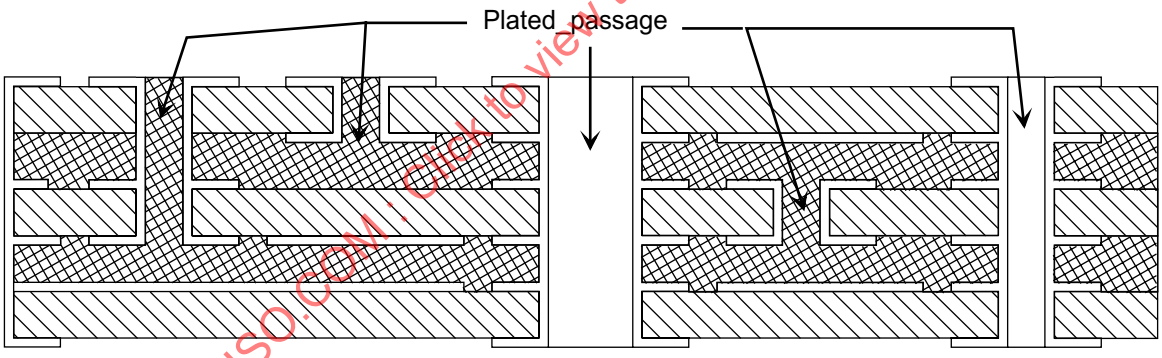

Figure 82 – Plated_passage

Constraints:

WR1: Each Plated_passage shall not be a member of Interconnect_module_edge.

WR2: Each Plated_passage shall not be a member of Interconnect_module_edge_segment.

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4.2.555 Plus_minus_tolerance_characteristic

A Plus_minus_tolerance_characteristic is a type of Tolerance_characteristic (see 5.2.4.168). The Plus_-minus_tolerance_characteristic includes a minimum, maximum, and nominal characteristic numeric parameter. All three have the same base unit, but may have different prefixes.

The data associated with a Plus_minus_tolerance_characteristic are the following:

— component_characteristic.

4.2.555.1 component_characteristic

The component_characteristic specifies the nominal, minimum, and maximum values of the Numeric_-parameter (see 4.2.460) for the Plus_minus_tolerance_characteristic. There shall be one nominal, one minimum and one maximum value for the Plus_minus_tolerance_characteristic.

Constraints:

WR1: All Data_element referenced by Numeric_parameter in the role of component_characteristic for Plus_minus_tolerance_characteristic shall have the same unit_of_measure.

WR2: The Numeric_parameter in the role of component_characteristic shall have a type_name of minimum, nominal, or maximum.

WR3: The Numeric_parameter in the role of component_characteristic that has a type_name of minimum shall have a property_value that is less than the property_value of the Numeric_parameter in the role of component_characteristic that has a type_name of nominal.

WR4: The Numeric_parameter in the role of component_characteristic that has a type_name of nominal shall have a property_value that is less than the property_value of the Numeric_parameter in the role of component_characteristic that has a type_name of maximum.

4.2.556 Plus_minus_tolerance_range_representation

A Plus_minus_tolerance_range_representation is a type of Shape_dimension_representation (see 4.2.644) that represents a Dimensional_characteristic (see 4.2.256) with three Data_element (see 4.2.173) from which the limits of the Dimensional_characteristic can be calculated.

The data associated with a Plus_minus_tolerance_range_representation are the following:

— basic_dimension_value;

— lower_deviation;

— upper_deviation.

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4.2.556.1 basic_dimension_value

The basic_dimension_value specifies the Data_element (see 4.2.173) from which the lower and upper limits of the associated Dimensional_characteristic (see 4.2.256) may be calculated.

NOTE 1 The basic_dimension_value corresponds to the basic size component of toleranced dimensions and is described in ISO 286-1 and ISO 406.

NOTE 2 The basic_dimension_value should not be confused with basic dimensions defined in 1.3.9 of ASME Y14.5M.

4.2.556.2 lower_deviation

The lower_deviation specifies the Data_element (see 4.2.173) that is added to the Data_element specified by the basic_dimension_value to determine the lower limit of the associated Dimensional_characteristic (see 4.2.256).

4.2.556.3 upper_deviation

The upper_deviation specifies the Data_element (see 4.2.173) that is added to the Data_element specified by the basic_dimension_value to determine the upper limit of the associated Dimensional_characteristic (see 4.2.256).

Constraints:

WR1: The units of the Data_elements specified by the basic_dimension_value, lower_deviation, and upper_deviation shall be the same.

WR2: The value of the Data_element specified by the lower_deviation shall be less than the value of the Data_element specified by the upper_deviation.

4.2.557 Polarity_indication_feature

A Polarity_indication_feature is a type of Part_feature (see 4.2.494). A Polarity_indication_feature provides visible or tactile means to reduce or eliminate ambiguity of the location of a polarized part in an assembly operation. A Polarity_indication_feature shall not be used to identify orientation features of non-polarized components.

NOTE Other orientation information may be required in addition to the Polarity_indication_feature to totally disambiguate the correct orientation.

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4.2.558 Position_tolerance

A Position_tolerance is a type of Geometric_tolerance (see 5.2.4.386) that specifies or partially specifies the design requirement on the location of a Shape_element (see 4.2.645) in relation to other Shape_elements, such as a Datum_system (see 5.2.4.316). A Position_tolerance is either a Position_tolerance_with_referenced_datum_system (see 4.2.559) or a Position_tolerance_without_referenced_datum_system (see 5.2.4.399). A Position_tolerance may also be a Composite_feature_relating_position_tolerance (see 5.2.4.113).

NOTE Position tolerance is defined in terms of tolerance zone definitions in 14.10 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Centre_axis, Centre_plane, Centre_point, or Physical_feature_or_part_template.

WR2: If the toleranced_shape_element is a Centre_plane, the Position_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_size.

WR3: If the toleranced_shape_element is a Centre_point the Position_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a position tolerance is sensible.

4.2.559 Position_tolerance_with_referenced_datum_system

A Position_tolerance_with_referenced_datum_system is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) and a type of Position_tolerance (see 4.2.558) that participates in specifying a design requirement on the location of the toleranced Shape_element (see 4.2.645) in relation to a Datum_system (see 5.2.4.316). A Position_tolerance_with_referenced_datum_system may be either a Composite_feature_locating_position_tolerance (see 5.2.4.82) or a Boundary_based_position_tolerance (see 4.2.59).

4.2.560 Position_tolerance_without_referenced_datum_system

A Position_tolerance_without_referenced_datum_system is a type of Position_tolerance (see 4.2.558) and a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) that participates in specifying a design requirement on the location of the toleranced Shape_element (see 4.2.645) in relation to other Shape_element that are not Datum_system (see 5.2.4.316).

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4.2.561 Positional_boundary

A Positional_boundary is a type of Non_feature_shape_element (see 5.2.4.127) that is a theoretical boundary that is defined by a Boundary_based_position_tolerance (see 4.2.59). The theoretical boundary is a boundary that cannot be intruded upon by the toleranced Physical_feature_or_part_template (see 4.2.527) if the Physical_feature_or_part_template is an internal Physical_feature_or_part_template (e.g., a hole) and the Boundary_based_position_tolerance is applied on a "maximum material principle" basis, or if the toleranced Physical_feature_or_part_template is an external Physical_feature_or_part_template (e.g., a tab) and the Boundary_based_position_tolerance is applied on a "least material requirement" basis. Additionally, the theoretical boundary is a boundary that cannot be escaped by the toleranced Physical_feature_or_part_template if the Physical_feature_or_part_template is an internal Physical_feature_or_part_template and the Boundary_based_position_tolerance is applied on a "least material requirement" basis, or if the toleranced Physical_feature_or_part_template is an external Physical_feature_or_part_template and the Boundary_based_position_tolerance is applied on a "maximum material principle" basis. A Positional_boundary is either a Profile_related_positional_boundary (see 4.2.599) or a Dimension_related_positional_boundary (see 5.2.4.390).

The data associated with a Positional_boundary are the following:

— boundary_definition.

4.2.561.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Positional_boundary is dependent on the existence of the Positional_boundary_definition (see 5.2.4.323) that specifies the Positional_boundary as its defined_positional_boundary.

4.2.562 Positional_boundary_and_profile_boundary_member_relationship

A Positional_boundary_and_profile_boundary_member_relationship is a type of Managed_design_object (see 4.2.431). A Positional_boundary_and_profile_boundary_member_relationship is a relationship that associates a Profile_related_positional_boundary (see 4.2.599) with the Tolerance_zone_boundary_member (see 4.2.736) from which the Profile_related_positional_boundary is offset.

The data associated with a Positional_boundary_and_profile_boundary_member_relationship are the following:

— base_profile_tolerance_zone_boundary_member;

— offset;

— offset_positional_boundary.

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4.2.562.1 base_profile_tolerance_zone_boundary_member

The base_profile_tolerance_zone_boundary_member specifies the Tolerance_zone_boundary_member (see 4.2.736) from which the Profile_related_positional_boundary (see 4.2.599) specified as the offset_-positional_boundary is offset.

4.2.562.2 offset

The offset is an inverse relationship that specifies that the existence of the Positional_boundary_and_-profile_boundary_member_relationship is dependent on the existence of the Positional_boundary_offset (see 4.2.566) that specifies the Positional_boundary_and_profile_boundary_member_relationship as its offset_boundary_relationship.

4.2.562.3 offset_positional_boundary

The offset_positional_boundary specifies the Profile_related_positional_boundary (see 4.2.599) that is offset from the Tolerance_zone_boundary_member (see 4.2.736) that is specified as the base_profile_-tolerance_zone_boundary_member.

4.2.563 Positional_boundary_definition

A Positional_boundary_definition is a type of Managed_design_object (see 4.2.431). A Positional_-boundary_definition is a definition that characterizes a Positional_boundary (see 4.2.561). A Positional_boundary_definition is either a Profile_related_positional_boundary_definition (see 5.2.4.72) or a Dimension_related_positional_boundary_definition (see 5.2.4.385).

The data associated with a Positional_boundary_definition are the following:

— defined_positional_boundary.

4.2.563.1 defined_positional_boundary

The defined_positional_boundary specifies the Positional_boundary (see 4.2.561) that is characterized by the Positional_boundary_definition.

4.2.564 Positional_boundary_member

A Positional_boundary_member is a type of Non_feature_shape_element (see 5.2.4.127) that is a member of a Dimension_related_positional_boundary (see 5.2.4.390). A Positional_boundary_member is defined by a Boundary_based_position_tolerance (see 4.2.59) in conjunction with a Dimensional_size (see 4.2.259).

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The data associated with a Positional_boundary_member are the following:

— boundary_member_definition;

— composed_positional_boundary.

4.2.564.1 boundary_member_definition

The boundary_member_definition is an inverse relationship that specifies that the existence of the Positional_boundary_member is dependent on the existence of the Positional_boundary_member_definition (see 5.2.4.324) that specifies the Positional_boundary_member as its defined_positional_boundary_member.

4.2.564.2 composed_positional_boundary

The composed_positional_boundary is an inverse relationship that specifies that the existence of the Positional_boundary_member is dependent on the existence of the Dimension_related_positional_boundary (see 5.2.4.390) that specifies the Positional_boundary_member as one of its boundary_members.

4.2.565 Positional_boundary_member_definition

A Positional_boundary_member_definition is a type of Managed_design_object (see 4.2.431). A Positional_boundary_member_definition is a definition that characterizes a Positional_boundary_member (see 5.2.4.321). Each Positional_boundary_member_definition is defined by a Boundary_based_position_tolerance (see 4.2.59) in conjunction with a Dimensional_size (see 4.2.259). The shape of the Positional_boundary_member is identical to that of the toleranced Physical_feature_or_part_template (see 4.2.527). However, the size of the Positional_boundary_member is based on the associated Dimensional_size, the material conditions specified by the associated Boundary_based_position_tolerance, and whether the toleranced Physical_feature_or_part_template is an internal (e.g., a pair of opposing slot sides) or an external (e.g., a pair of opposing tab sides) Physical_feature_or_part_template.

The data associated with a Positional_boundary_member_definition are the following:

— associated_dimension;

— boundary_definition;

— defined_positional_boundary_member;

— tolerance_value.

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4.2.565.1 associated_dimension

The associated_dimension specifies the Dimensional_size (see 4.2.259) that defines the maximum material size and minimum material size of the toleranced Physical_feature_or_part_template (see 4.2.527). If the associated Boundary_based_position_tolerance (see 4.2.59) is specified on a "maximum material principle" basis, the maximum material size is used as the base size to which the Length_data_element (see 4.2.422) specified as the tolerance_value is subtracted if the toleranced Physical_feature_or_part_template is an internal Physical_feature_or_part_template, or added if the toleranced Physical_feature_or_part_template is an external Physical_feature_or_part_template. If the associated Boundary_based_position_tolerance is specified on a "least material requirement" basis, the least material size is used as the base size to which the Length_data_element specified as the tolerance_value is added if the toleranced Physical_feature_or_part_template is an internal Physical_feature_or_part_template, or subtracted if the toleranced Physical_feature_or_part_template is an external Physical_feature_or_part_template.

4.2.565.2 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Positional_boundary_member_definition is dependent on the existence of the Dimension_related_positional_boundary_definition (see 5.2.4.385) that specifies the Positional_boundary_member_definition as one of its characterized_boundary_member_definitions.

4.2.565.3 defined_positional_boundary_member

The defined_positional_boundary_member specifies the Positional_boundary_member (see 5.2.4.321) that is characterized by the Positional_boundary_member_definition.

4.2.565.4 tolerance_value

The tolerance_value specifies the Length_data_element (see 4.2.422) that represents the amount the size of the Positional_boundary_member (see 5.2.4.321) is reduced or enlarged from the base size that is determined by the associated Dimensional_size (see 4.2.259) and the material condition specified by the associated Boundary_based_position_tolerance (see 4.2.59).

Constraints:

WR1: The Dimension_related_positional_boundary specified as the composed_positional_boundary by the Positional_boundary_member that is specified as the defined_positional_boundary_member shall be the same instance of Dimension_related_positional_boundary as specified as the defined_positional_boundary by the Dimension_related_positional_boundary_definition that is specified as the boundary_definition.

WR2: The Positional_boundary_member_definition shall be specified by exactly one Geometric_tolerance as the tolerance_zone_or_boundary_definition, and that Geometric_tolerance shall be a Boundary_based_position_tolerance.

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4.2.566 Positional_boundary_offset

A Positional_boundary_offset is a type of Managed_design_object (see 4.2.431). A Positional_boundary_offset is a definition that characterizes the offset of a Profile_related_positional_boundary (see 4.2.599) from a Tolerance_zone_boundary_member (see 4.2.736).

The data associated with a Positional_boundary_offset are the following:

— boundary_definition;

— offset_boundary_relationship;

— tolerance_value.

4.2.566.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Positional_boundary_offset is dependent on the existence of the Profile_related_positional_boundary_definition (see 5.2.4.72) that specifies the Positional_boundary_offset as its boundary_offset.

4.2.566.2 offset_boundary_relationship

The offset_boundary_relationship specifies the Positional_boundary_and_profile_boundary_member_relationship (see 4.2.562) that associates the Profile_related_positional_boundary (see 4.2.599) with the Tolerance_zone_boundary_member (see 4.2.736) from which it is offset, and which is characterized by the Positional_boundary_offset.

4.2.566.3 tolerance_value

The tolerance_value specifies the Length_data_element (see 4.2.422) for the Positional_boundary_offset. The associated Profile_related_positional_boundary (see 4.2.599) is offset from the associated Tolerance_zone_boundary_member (see 4.2.736) by half the distance specified by the tolerance_value.

4.2.567 Positive_ratio_measure

A Positive_ratio_measure is a type of Managed_design_object (see 4.2.431). A Positive_ratio_measure is a measurement expressed as a ratio, with the arithmetic sign of plus.

4.2.568 Pre_defined_dimension_qualifier

A Pre_defined_dimension_qualifier is a type of Dimension_qualifier (see 5.2.4.183) the intent of which is unambiguous and is commonly used in geometric dimensioning.

The data associated with a Pre_defined_dimension_qualifier are the following:

— description.

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4.2.568.1 description

The description specifies the label that describes the manner in which the Dimensional_characteristic (see 4.2.256) that are specified as the qualified_dimensions are qualified by the Pre_defined_dimension_-qualifier. The description shall be either "average", or "free_state".

NOTE The attribute qualified_dimensions is declared in the Dimension_qualifier entity of which this entity is a subtype.

4.2.569 Pre_defined_geometric_tolerance_qualifier

A Pre_defined_geometric_tolerance_qualifier is a type of Geometric_tolerance_qualifier (see 5.2.4.74) the intent of which is unambiguous and is commonly used in geometric tolerancing.

The data associated with a Pre_defined_geometric_tolerance_qualifier are the following:

— description.

4.2.569.1 description

The description specifies the label that describes the manner in which the Geometric_tolerance (see 5.2.4.386) that are specified as the qualified_geometric_tolerances are qualified by the Pre_defined_-geometric_tolerance_qualifier. The description shall be either "each_element", "each_radial_element", "free_state", "major_diameter", "minor_diameter", "not_concave", "not_convex", or "pitch_diameter".

NOTE The attribute qualified_geometric_tolerances is declared in the Geometric_tolerance_qualifier entity of which this entity is a subtype.

EXAMPLE 1 "each element" is a commonly used qualifier that indicates the requirement specified by the geometric tolerance to which the qualifier is applied. "each_element" is on each line element of the feature to which the geometric tolerance is applied rather than on the feature as a whole.

4.2.570 Primary_orientation_feature

A Primary_orientation_feature is a type of Part_feature (see 4.2.494). A Primary_orientation_feature participates in providing for the unambiguos orientation of a part on its next assembly.

EXAMPLE 1 Figure 83 illustrates two of the three-dimensional geometric relationships between a component and the printed circuit board it is mounted on. A Datum_system (see 5.2.4.316) is included for reference purposes. The Z direction is parallel to the normal of the top surface of the board. Both the top and bottom surface normal vectors are parallel to the normal vectors of the seating plane for the components.

EXAMPLE 2 Figure 84 illustrates two of the two-dimensional geometric relationships between a component and the printed circuit board it is mounted on. A Datum_system (see 5.2.4.316) is included for reference purposes.

EXAMPLE 3 Figures 85 through 89 illustrates orientation details for microcircuit packages.

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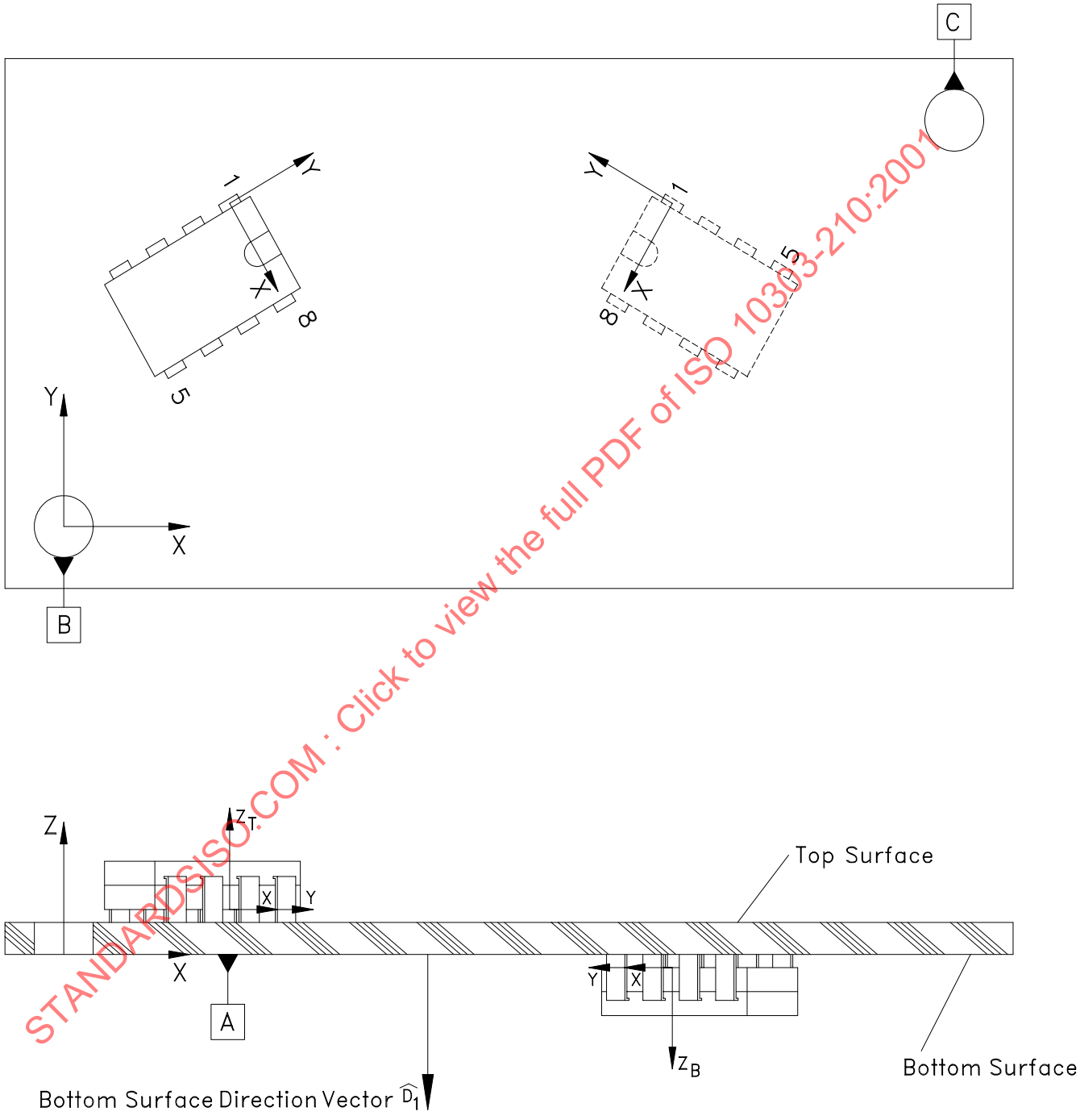

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Figure 83 – Three-dimensional assembly relationships

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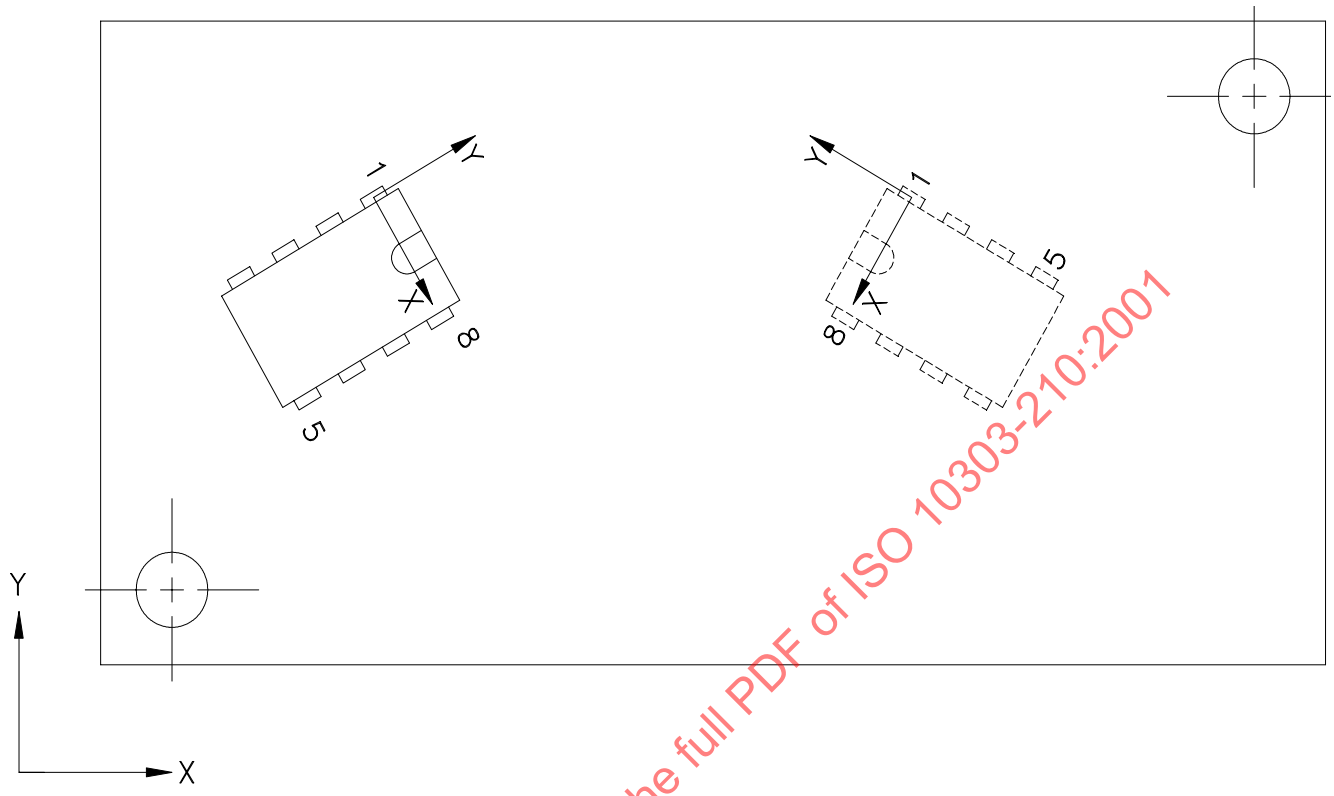

Figure 84 – Two-dimensional assembly relationships

EXAMPLE 4 Figure 90 illustrates details associated with several variations of an Axial package modification and the associated seating_plane. In all these cases, the seating plane orientation with respect to the Axis_placement (see 4.2.43) is constant, while the Package (see 4.2.466) shape orientation changes due to the modification.

EXAMPLE 5 Figure 91 illustrates Primary_reference_terminal (see 4.2.571) assignment and also assignment of Polarity_indication_feature. Knowledge of Polarity_indication_features separate from the orientation feature increases the ability to determine when to use polarity indication symbols on the interconnect substrate for polarized components e.g., polarized capacitors, diodes).

4.2.571 Primary_reference_terminal

A Primary_reference_terminal is a type of Package_terminal (see 4.2.472). This terminal is assigned the first identifier string in the sequence of package terminal names to be assigned to the part. The Primary_reference_terminal shall not specify a precedent_feature and is the first member of the sequence of Package_terminal. The sort order of the names assigned to the Packaged_terminals is defined by the explicit sequence established by the use of precedent_feature inherited from Part_feature.

EXAMPLE 1 If a value of '1' is available, assigning a value of '2' to this terminal would be prohibited by this part of ISO 10303, due to the possibility of confusion.

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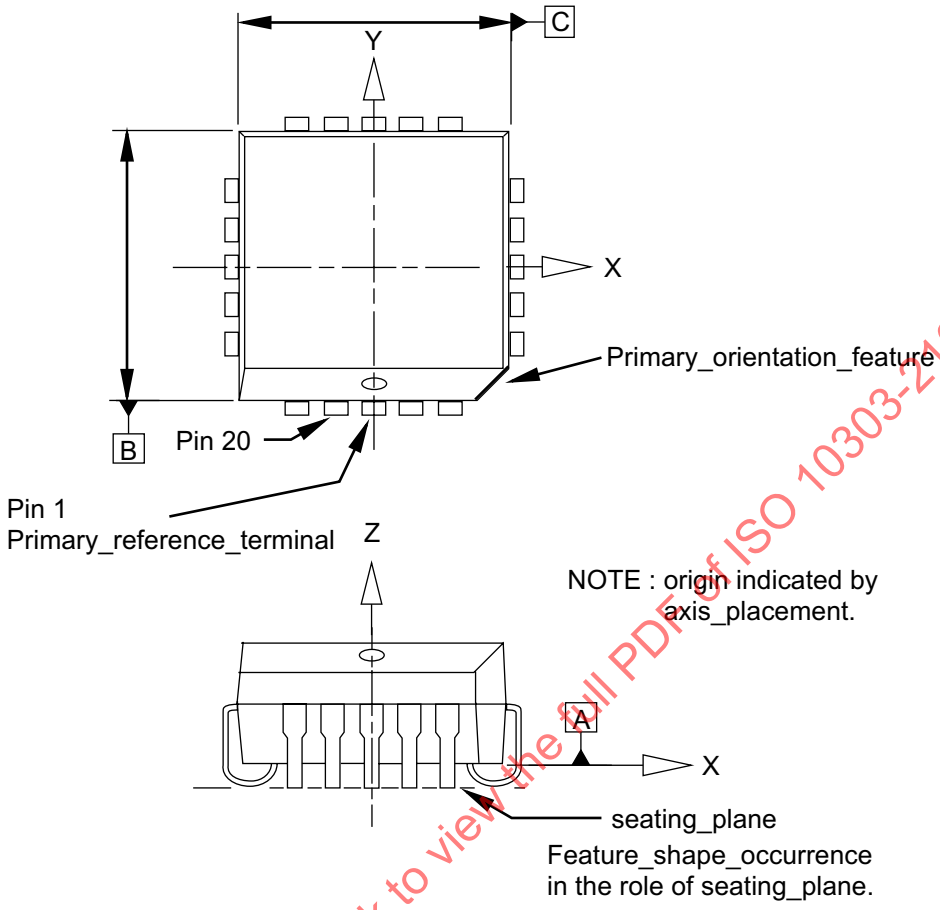

Figure 85 – Twenty pin orientation features

NOTE The Primary_reference_terminal is often associated with an orientation feature, but it may not be the orientation feature itself. Usually the Primary_reference_terminal and the Primary_orientation_feature (see 4.2.570) are different part_features.

Constraints:

WR1: The precedent_feature inherited from Part_feature shall not be provided for a Primary_reference_terminal.

4.2.572 Primary_stratum_indicator_symbol

A Primary_stratum_indicator_symbol is a type of Special_symbol_laminate_component (see 4.2.667) that is used to identify the arbitrarily named primary side of a printed circuit board.

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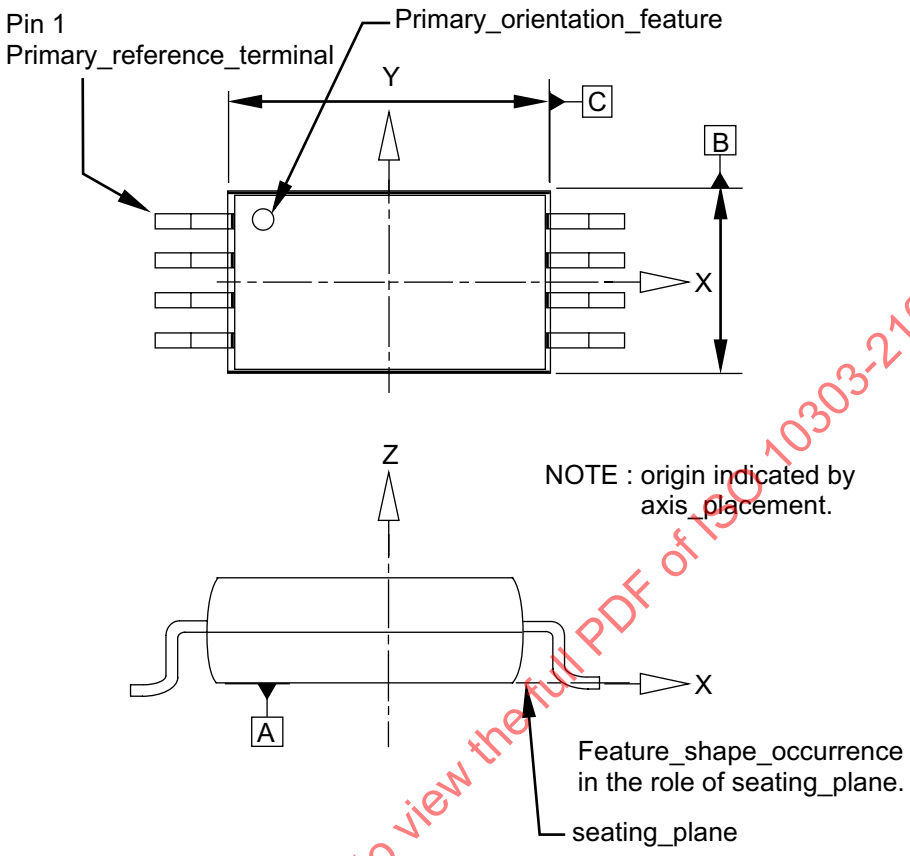

Figure 86 – Eight lead gull wing orientation features

NOTE This symbol may be found in the stratum material of the conductive stratum that is on the primary side of the printed circuit board, implemented in a stratum of silk-screen printed marking ink on the primary side, or otherwise. The primary side is normally defined as that side of the printed circuit board which will contain the largest number of components, but in cases where the component count is balanced, the primary side is arbitrarily named for convenience. Not all printed circuit boards contain this symbol.

Constraints:

WR1: The value of the attribute primary_design_layer_stratum shall be TRUE for the Design_layer_-stratum in the role of resident_stratum for the member of Stratum_feature in the role of stratum_feature_-implementation inherited from the supertype Stratum_feature_template_component.

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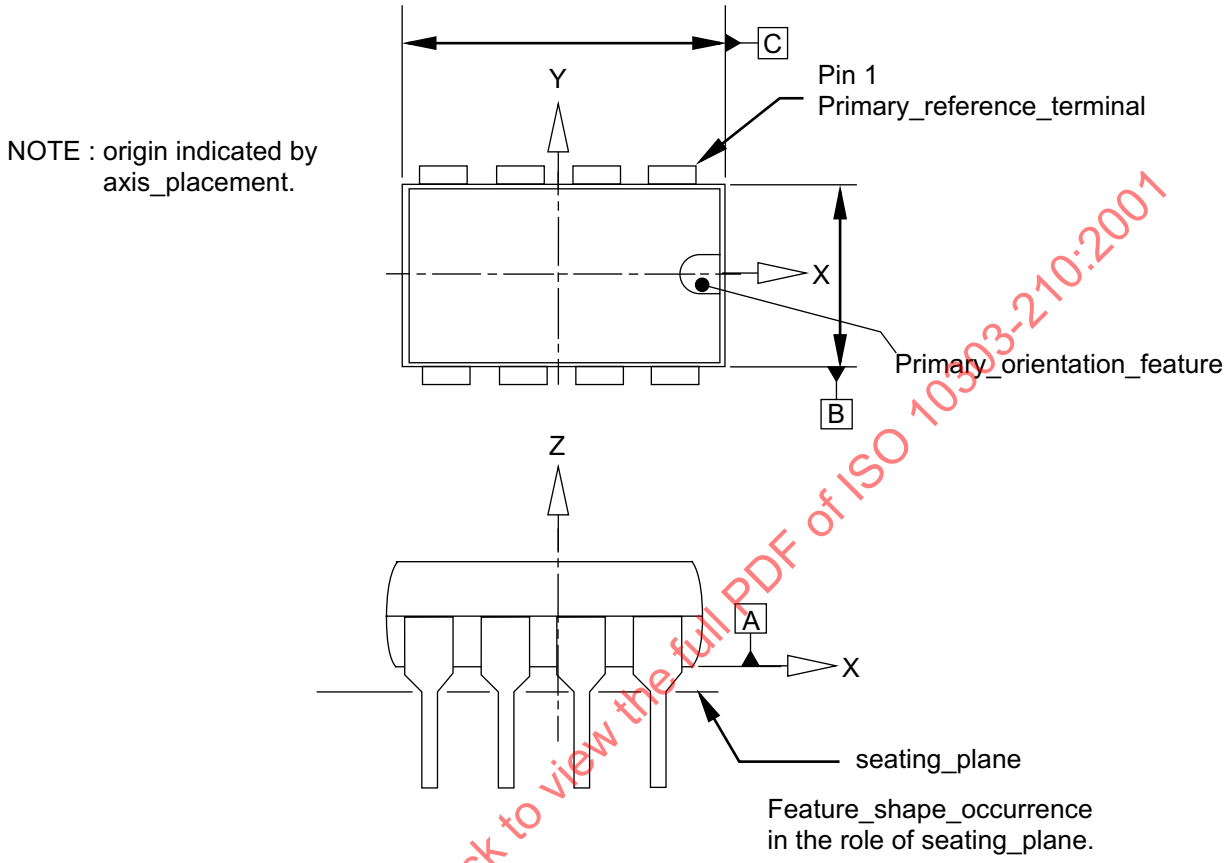

Figure 87 – Eight lead DIP orientation features

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4.2.573 Printed_component

A Printed_component is a type of Laminate_component (see 4.2.404). A Printed_component may be a Join_two_physical_connectivity_definition_supporting_printed_component (see 5.2.4.245) or a Printed_connector_component (see 4.2.575). A Printed_component is an occurrence of Printed_part_template (see 5.2.4.355) that is used as an Assembly_component (see 4.2.27) in an Interconnect_module (see 4.2.372). A Printed_component is manufactured integral to an Interconnect_module (see 4.2.372).

The data associated with a Printed_component are the following:

— access_mechanism;

— stratum_feature_implementation;

— usage_definition.

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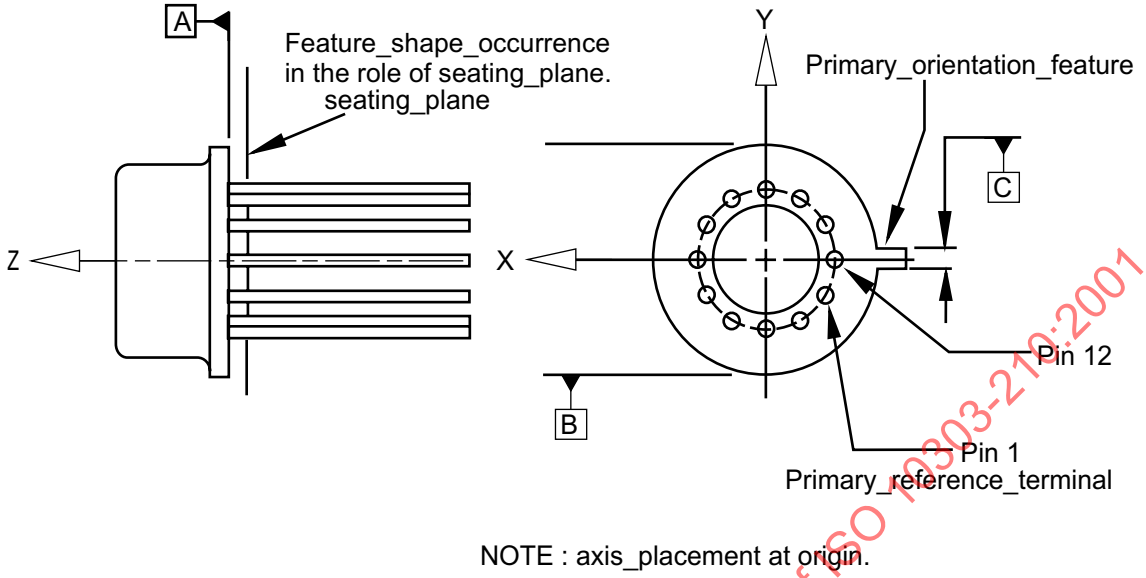

Figure 88 – TO-99 orientation features

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4.2.573.1 access_mechanism

The access_mechanism is an inverse relationship that specifies that the existence of the Printed_component is dependent on the existence of the Printed_component_join_terminal (see 5.2.4.109) that specifies the Printed_component as its associated_component. There shall be one or more Printed_component_join_terminal for a Printed_component.

4.2.573.2 stratum_feature_implementation

The stratum_feature_implementation specifies the Stratum_feature (see 4.2.683) for the Printed_component. There shall be one or more Stratum_feature for a Printed_component.

4.2.573.3 usage_definition

The usage_definition specifies the Printed_part_template (see 5.2.4.355) for the definition for the Printed_component.

4.2.574 Printed_component_join_terminal

A Printed_component_join_terminal is a type of Component_terminal (see 4.2.105). This terminal is a terminus for internal circuitry in the interconnect substrate.

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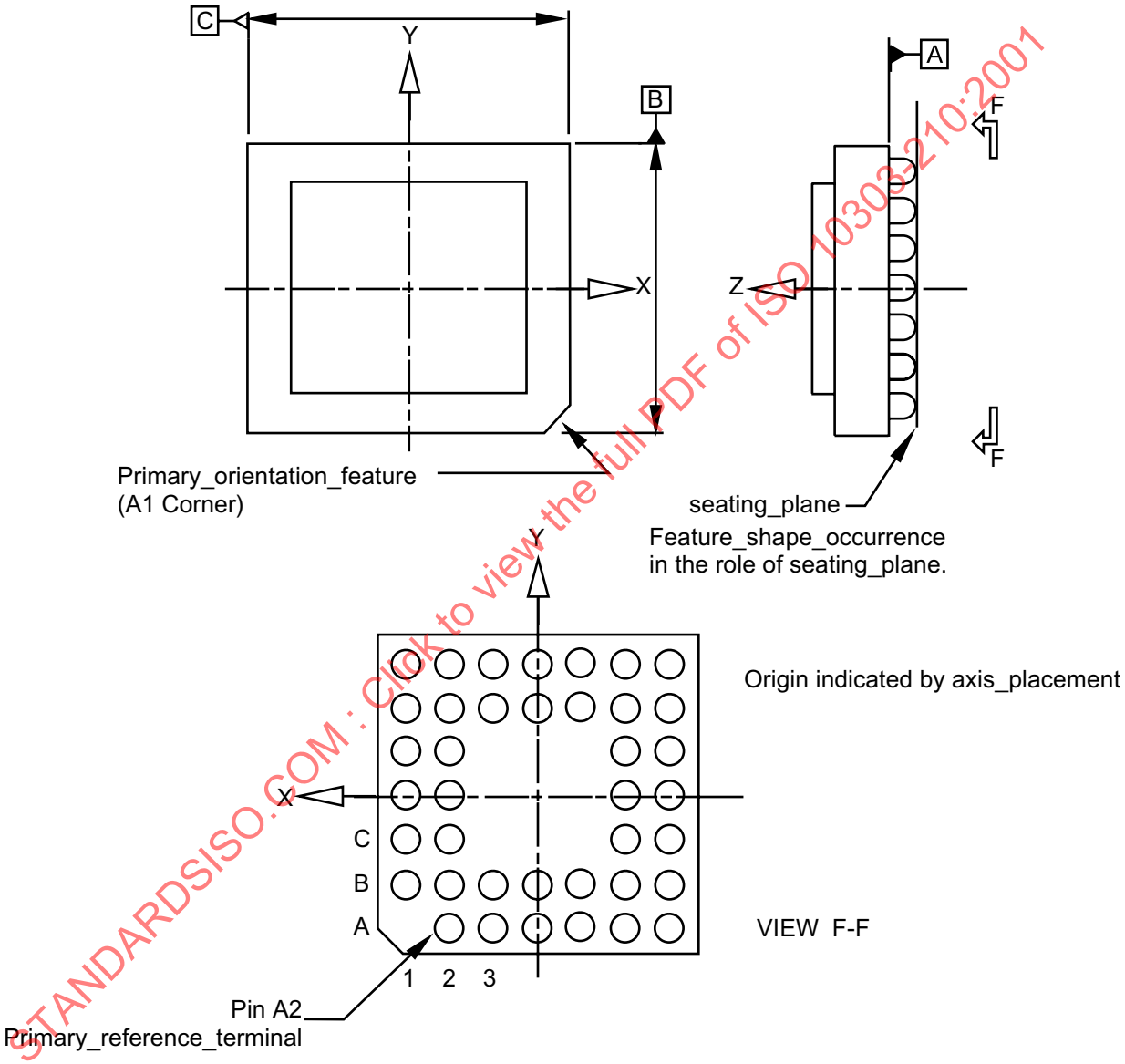

Figure 89 – Ball grid array orientation features

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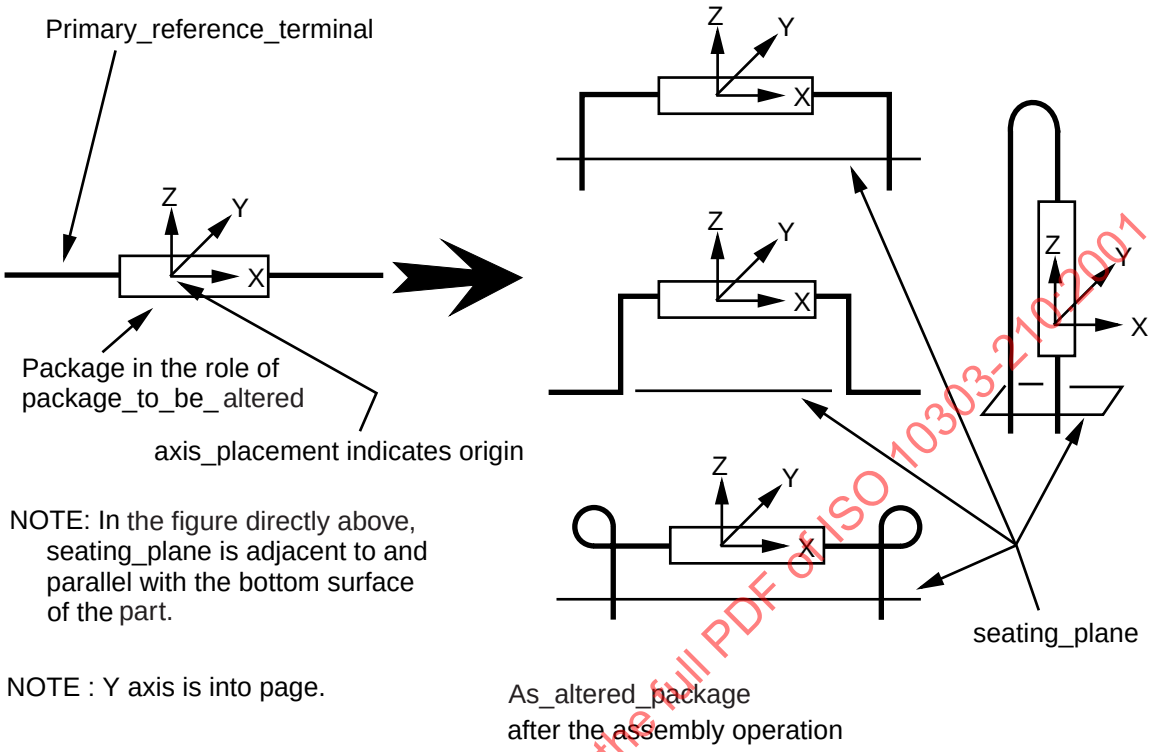

Figure 90 – Axial Package modifications and resulting orientations

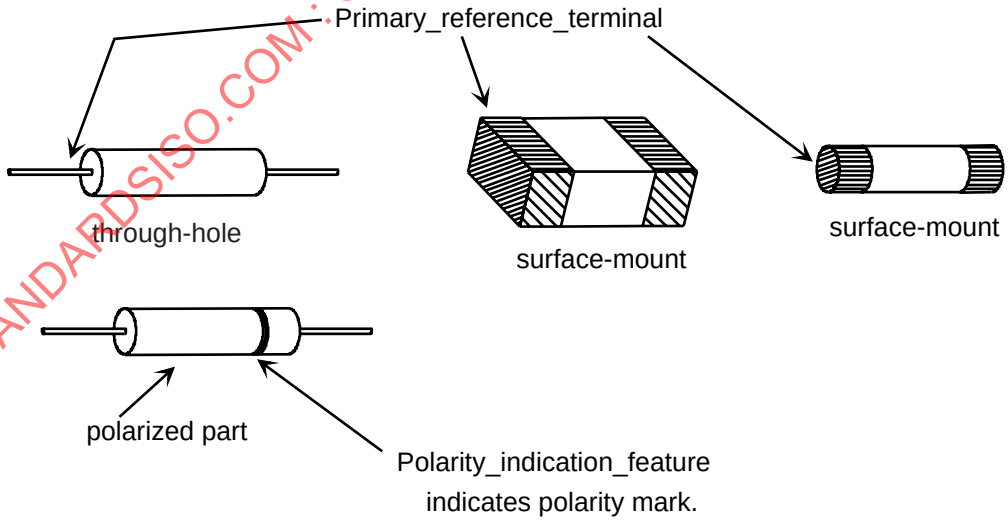

Figure 91 – Primary_reference_terminal and Polarity_indication_feature for discrete devices

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EXAMPLE 1 Figure 92 illustrates a detail of a layout drawing that shows the internal terminals of the printed connector (edge connector).

The data associated with a Printed_component_join_terminal are the following:

— associated_component;

— connection;

— definition;

— stratum_concept_implementation_component.

4.2.574.1 associated_component

The associated_component specifies the Printed_component (see 5.2.4.246) being accessed by the Printed_component_join_terminal.

4.2.574.2 connection

The connection specifies the role of the Connection_zone (see 4.2.147) for the Printed_component_join_terminal.

4.2.574.3 definition

The definition specifies the Printed_part_template_join_terminal (see 4.2.584) that defines the Printed_component_join_terminal.

4.2.574.4 stratum_concept_implementation_component

The stratum_concept_implementation_component specifies either the Inter_stratum_feature (see 4.2.364), the Laminate_component (see 4.2.404), the Stratum (see 4.2.677), the Stratum_feature (see 4.2.683), or the Stratum_surface (see 4.2.699) for the Printed_component_join_terminal.

4.2.575 Printed_connector_component

A Printed_connector_component is a type of Printed_component (see 5.2.4.246). The Printed_connector_component is the occurrence of a printed_connector_template. The purpose of the Printed_connector_component is to provide access to the assembly in which the interconnect substrate, that the realized connector is part of, is installed.

The data associated with a Printed_connector_component are the following:

— interface_access_mechanism;

— usage_definition.

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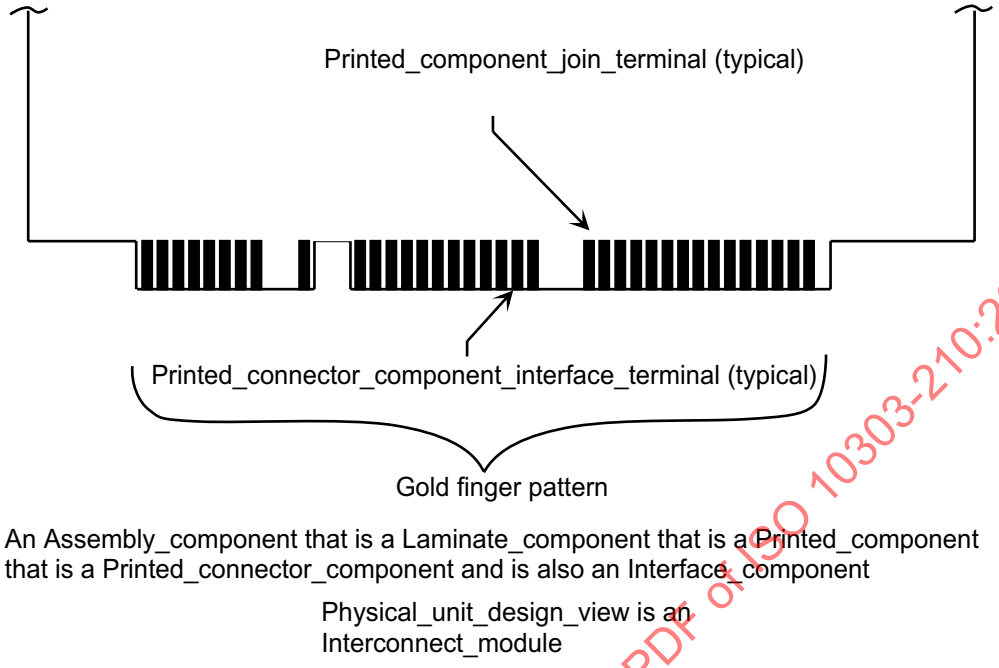

Figure 92 – Printed_connector_component and associated terminals

4.2.575.1 interface_access_mechanism

The interface_access_mechanism is an inverse relationship that specifies that the existence of the Printed_-connector_component is dependent on the existence of the Printed_connector_component_interface_terminal (see 4.2.576) that specifies the Printed_connector_component as its associated_component. There shall be one or more Printed_connector_component_interface_terminal for a Printed_connector_component.

4.2.575.2 usage_definition

The usage_definition specifies the role of the Printed_connector_template (see 4.2.577) for the Printed_-connector_component.

4.2.576 Printed_connector_component_interface_terminal

A Printed_connector_component_interface_terminal is a type of Component_feature (see 4.2.90). The Printed_connector_component_interface_terminal is an individual access mechanism (e.g., one terminal on a Printed_connector_component). "Interface" means it is not tied to the substrate as part of the fabrication or assembly operation.

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The data associated with a Printed_connector_component_interface_terminal are the following:

— associated_component;

— definition.

4.2.576.1 associated_component

The associated_component specifies the role of the Printed_connector_component (see 4.2.575) for the Printed_connector_component_interface_terminal.

4.2.576.2 definition

The definition specifies the role of the Printed_part_template_interface_terminal (see 4.2.583) for the Printed_connector_component_interface_terminal.

NOTE Use of this capability occurs when a member of Component_feature_to_physical_usage_view_assignment references a member of Printed_connector_component_interface_terminal.

4.2.577 Printed_connector_template

A Printed_connector_template is a type of a Printed_part_template (see 5.2.4.355). A Printed_connector_template is a Printed_part_template that contains contacts, each of whose function is to act as a short from an interface_terminal of a Printed_part_template to the related join_terminal of the Printed_part_-template. Each contact corresponds to one member of characterized_connector_terminal_relationship. The contact shall be a Part_template and the geometric relationship of the shape of the contact to the shape of the Printed_connector_template shall be established by a member of Usage_view_usage_relationship.

EXAMPLE 1 Figure 93 illustrates a template and associated parameters for one contact of a printed connector. Specific parameter values and explicit geometry will be provided for individual technology based contacts.

EXAMPLE 2 Figure 92 illustrates a detail of a layout drawing that shows an instance of the Printed_connector_-template.

NOTE 1 It is redundant to have a separate functional definition that merely specifies shorts for any type of connector in this part of ISO 10303, because the functional definition of a short is included in the definition of the connector. That is, a functional definition that worries about shorts is not a functional definition. It is appropriate to define the location of required shorts in the physical definition, and connector is one of the places in this part of ISO 10303 where that occurs.

NOTE 2 There may be multiple simulation models associated with a connector in this part of ISO 10303. The explicit method of defining the connector functionality does not prohibit having multiple simulation models. This explicit method is for the purpose of supporting the standardized structural definition of connectivity.

The data associated with a Printed_connector_template are the following:

— characterized_connector_terminal_relationship.

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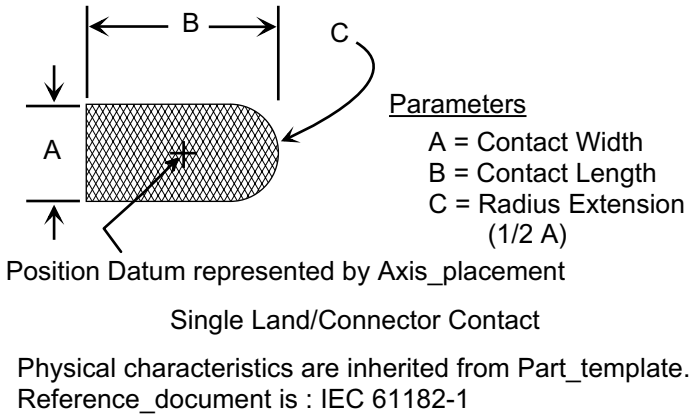

Figure 93 – Single contact of a Printed_connector_template

4.2.577.1 characterized_connector_terminal_relationship

The characterized_connector_terminal_relationship is an inverse relationship that specifies that the existence of the Printed_connector_template is dependent on the existence of the Printed_connector_template_terminal_relationship (see 4.2.578) that specifies the Printed_connector_template as its connector. There shall be one or more Printed_connector_template_terminal_relationship for a Printed_connector_template.

Constraints:

WR1: The material of individual contacts shall be disjoint.

WR2: A member of Usage_view_usage_relationship shall be populated for each member of characterized_connector_terminal_relationship to position the Part_template referenced indirectly by Printed_connector_template_terminal_relationship.

4.2.578 Printed_connector_template_terminal_relationship

A Printed_connector_template_terminal_relationship is a type of Managed_design_object (see 4.2.431). A Printed_connector_template_terminal_relationship is the definition of the connection between a Printed_part_template_interface_terminal (see 4.2.583) and a Printed_part_template_join_terminal (see 4.2.584) for one contact of a Printed_connector_template.

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NOTE 1 An occurrence of Printed_connector_template_terminal_relationship is only required at the Part model level in the Standard. A Printed_connector_component (see 4.2.575) that references a Printed_connector_template (see 4.2.577) has the visibility of this functional requirement by virtue of a mandatory inverse relationship to the Printed_connector_template_terminal_relationship on the Printed_connector_template.

NOTE 2 A Printed_connector_template_terminal_relationship is the actual specification of the short referred to in Printed_connector_template.

The data associated with a Printed_connector_template_terminal_relationship are the following:

— connector;

— interface_terminal;

— join_terminal.

4.2.578.1 connector

The connector specifies the role of the Printed_connector_template (see 4.2.577) for the Printed_connector_template_terminal_relationship.

4.2.578.2 interface_terminal

The interface_terminal specifies the role of the Printed_part_template_interface_terminal (see 4.2.583) for the Printed_connector_template_terminal_relationship.

4.2.578.3 join_terminal

The join_terminal specifies the role of the Printed_part_template_join_terminal (see 4.2.584) for the Printed_connector_template_terminal_relationship.

Constraints:

UR1: The combination of the join_terminal and the connector shall be unique within a population of Printed_connector_template_terminal_relationships.

UR2: The combination of the interface_terminal and the connector shall be unique within a population of Printed_connector_template_terminal_relationships.

WR1: The connector establishes the Part_template that has the contact with which the join_terminal is associated.

WR2: The connector establishes the Part_template that has the contact with which the interface_terminal is associated.

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4.2.579 Printed_part_cross_section_template

A Printed_part_cross_section_template is a type of Printed_part_template (see 5.2.4.355) that describes a cross sectional view of a Printed_part_template.

EXAMPLE 1 Figure 94 illustrates parameters, cross-sectional geometry, and materials needed to describe different transmission lines and related media.

The data associated with a Printed_part_cross_section_template are the following:

— maximum_width;

— minimum_width;

— transmission_line_model.

EXAMPLE 2 An example of Printed_part_cross_section_template is the two-dimensional shape based model in figure 94 for a regular transmission line structure. The cross sectional shape of the structure is invariant along the path of the center line of the structure. These structures include the definition of conductive Stratum_feature cross sections and the placement and location of dielectric Stratum in the Stratum_sequence. The width of each Stratum_feature is included.

4.2.579.1 maximum_width

The maximum_width specifies the maximum overall lateral Length_data_element (see 4.2.422) dimension through all the material of the Printed_part_cross_section_template.

4.2.579.2 minimum_width

The minimum_width specifies the minimum overall lateral Length_data_element (see 4.2.422) dimension through all the material of the Printed_part_cross_section_template.

4.2.579.3 transmission_line_model

The transmission_line_model specifies the role of the Analytical_model (see 4.2.10) for the Printed_part_cross_section_template.

Constraints:

WR1: There shall be more than one terminal provided for a Printed_part_cross_section_template.

4.2.580 Printed_part_cross_section_template_terminal

A Printed_part_cross_section_template_terminal is a type of Printed_part_template_terminal (see 4.2.586) that is the terminal of the Printed_part_cross_section_template (see 4.2.579).

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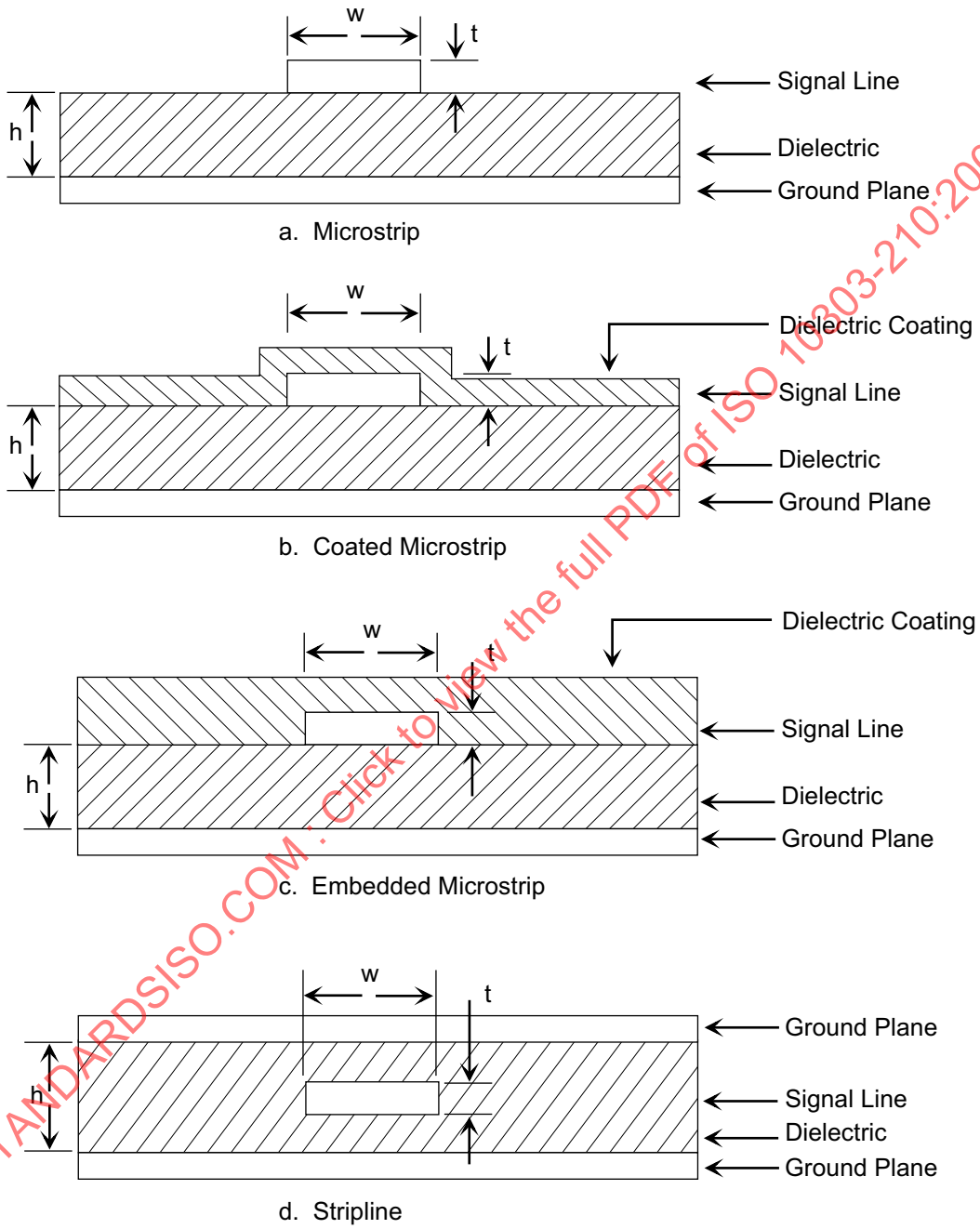

Figure 94 – Printed_part_cross_section_template

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The data associated with a Printed_part_cross_section_template_terminal are the following:

— associated_definition.

4.2.580.1 associated_definition

The associated_definition specifies the role of the Printed_part_cross_section_template (see 4.2.579) for the Printed_part_cross_section_template_terminal.

4.2.581 Printed_part_template

A Printed_part_template is a type of Part_template (see 4.2.498). Each Printed_part_template may be either one of or both of a Printed_connector_template (see 4.2.577) or a Printed_part_cross_section_-template (see 4.2.579). A Printed_part_template is a Part_template that has a specified function. Material may be discontiguous in a Printed_part_template.

NOTE 1 An occurrence of this object is a Printed_component (see 5.2.4.246) that is realized during the manufacturing process for the printed circuit board.

NOTE 2 The functionality realized in an occurrence of a Printed part is determined by the shape of the occurrence and the material constituting the occurrence.

EXAMPLE 1 Figure 95 illustrates shape data associated with single layer Printed_part. This part of ISO 10303 supports complex, specific purpose, multi-layer Printed_part exchange using the design reuse concept with the Interconnect_module (see 4.2.372) being a design view that contains the full multi-layer definition of the part design. Individual elements of the part design on a layer basis would be related to individual elements in the design being created using the Component_make_from_relationship (see 4.2.98).

The data associated with a Printed_part_template are the following:

— access_mechanisms;

— characterized_material;

— cross_section;

— implemented_function.

4.2.581.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Printed_part_-template is dependent on the existence of the Printed_part_template_terminal (see 4.2.586) that specifies the Printed_part_template as its associated_definition. There shall be two or more Printed_part_template_terminal for a Printed_part_template.

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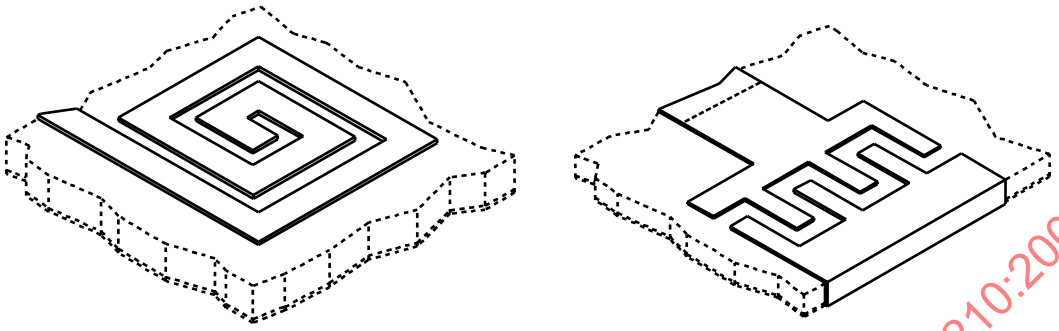

Figure 95 – Printed_part_template

4.2.581.2 characterized_material

The characterized_material specifies the sequence of Printed_part_template_material (see 4.2.585) required to realize an implementation of a Printed_part_template, including conductive and dielectric materials. There shall be one or more Printed_part_template_material for a Printed_part_template, and the same characterized_material may occur more than once in the sequence.

NOTE The members of the sequence characterized_material need not be unique because the Printed_part_-template is an incomplete set of information that is used as a reference in the construction of the complete product data for a design. The complete material shapes are not defined.

4.2.581.3 cross_section

The cross_section specifies the role of the Printed_part_cross_section_template (see 4.2.579) for the Printed_part_template. The cross_section need not be specified for a particular Printed_part_template.

4.2.581.4 implemented_function

The implemented_function specifies the role of the Functional_unit_usage_view (see 4.2.347) for the Printed_part_template.

Constraints:

WR1: The function this member of Printed_part_template implements shall be the associated function for the functional terminals mapped to the terminals of this member of Printed_part_template.

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4.2.582 Printed_part_template_connected_terminals_definition

A Printed_part_template_connected_terminals_definition is a type of Managed_design_object (see 4.2.431). A Printed_part_template_connected_terminals_definition is the association between two or more Printed_-part_template_terminal (see 4.2.586) that are connected.

The data associated with a Printed_part_template_connected_terminals_definition are the following:

— connected_terminals;

— name.

4.2.582.1 connected_terminals

The connected_terminals specify the Printed_part_template_terminal (see 4.2.586) for the Printed_part_-template_connected_terminals_definition. There shall be two or more Printed_part_template_terminal for the Printed_part_template_connected_terminals_definition.

4.2.582.2 name

The name identifies the Printed_part_template_connected_terminals_definition.

Constraints:

UR1: The name shall be unique within a population of Printed_part_template_connected_terminals_-definitions.

4.2.583 Printed_part_template_interface_terminal

A Printed_part_template_interface_terminal is a type of Printed_part_template_terminal (see 4.2.586), an occurrence of which is an external access to the printed circuit board of which it is a component.

The data associated with a Printed_part_template_interface_terminal are the following:

— external_connector_function.

4.2.583.1 external_connector_function

The external_connector_function is an inverse relationship that specifies the Printed_connector_tem-plate_terminal_relationship (see 4.2.578) that specifies the Printed_part_template_interface_terminal as its interface_terminal. There shall be one or more Printed_connector_template_terminal_relationship for a Printed_part_template_interface_terminal.

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4.2.584 Printed_part_template_join_terminal

A Printed_part_template_join_terminal is a type of Printed_part_template_terminal (see 4.2.586) an occurrence of which provides access to the functionality of the Printed_part_template (see 5.2.4.355) from within a printed circuit board.

NOTE Join is a concept that explicitly states the purpose is for completing the network connections internal to a physical design.

The data associated with a Printed_part_template_join_terminal are the following:

— internal_connector_function.

4.2.584.1 internal_connector_function

The internal_connector_function is an inverse relationship that specifies the Printed_connector_template_terminal_relationship (see 4.2.578) that specifies the Printer_part_template_join_terminal as its join_terminal. There shall be no more than one Printed_connector_template_terminal_relationship for a Printed_part_template_join_terminal.

4.2.585 Printed_part_template_material

A Printed_part_template_material is a type of Managed_design_object (see 4.2.431). A Printed_part_-template_material is the Ee_material (see 4.2.273) characterized in Printed_part_cross_section_template (see 4.2.579), for the realization of the Stratum (see 4.2.677) containing part of the Printed_component (see 5.2.4.246) during fabrication of the Interconnect_module (see 4.2.372).

NOTE A Printed_component may span more than one Stratum, as defined by the Printed_part_template (see 5.2.4.355).

The data associated with a Printed_part_template_material are the following:

— maximum_thickness;

— minimum_thickness;

— required_material.

4.2.585.1 maximum_thickness

The maximum_thickness specifies the maximum Length_data_element (see 4.2.422) for the thickness of the Printed_part_template_material.

4.2.585.2 minimum_thickness

The minimum_thickness specifies the minimum Length_data_element (see 4.2.422) for the thickness of the Printed_part_template_material.

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4.2.585.3 required_material

The required_material specifies the role of the Ee_material (see 4.2.273) for the Printed_part_template_-material.

4.2.586 Printed_part_template_terminal

A Printed_part_template_terminal is a type of Managed_design_object (see 4.2.431). A Printed_part_-template_terminal is a Printed_part_cross_section_template_terminal (see 4.2.580) or additionally one of a Printed_part_template_interface_terminal (see 4.2.583) or a Printed_part_template_join_terminal (see 4.2.584). A Printed_part_template_terminal is a terminal of a Printed_part_template (see 5.2.4.355).

The data associated with a Printed_part_template_terminal are the following:

— associated_definition;

— connection_requirement;

— connection_zone_category;

— feature_shape;

— functional_usage_view_terminal;

— name;

— terminal_connection_zone.

4.2.586.1 associated_definition

The associated_definition specifies the role of the Printed_part_template (see 5.2.4.355) for the Printed_-part_template_terminal.

4.2.586.2 connection_requirement

The connection_requirement is an inverse relationship that specifies that the existence of the Printed_-part_template_terminal is dependent on the existence of the Printed_part_template_connected_termi-nals_definition (see 4.2.582) that specifies the Printed_part_template_terminal as its connected_termi-nals. There shall be no more than one Printed_part_template_connected_terminals_definition for a Printed_part_template_terminal.

4.2.586.3 connection_zone_category

The connection_zone_category specifies either an area_edge_segment, a curve_edge_segment, a sur-face_area, or a surface_point for the Printed_part_template_terminal.

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4.2.586.4 feature_shape

The feature_shape specifies the role of the Feature_shape_occurrence (see 4.2.316) for the Printed_part_template_terminal. There shall be one or more Feature_shape_occurrence for the Printed_part_template_terminal.

4.2.586.5 functional_usage_view_terminal

The functional_usage_view_terminal is an inverse relationship that specifies the Functional_usage_view_to_printed_part_template_terminal_assignment (see 5.2.4.343) that specifies the Printed_part_template_terminal as its physical_usage_view_terminal. There shall be no more than one Functional_usage_view_to_printed_part_template_terminal_assignment for a Printed_part_template_terminal.

4.2.586.6 name

The name identifies the descriptive label for the Printed_part_template_terminal.

4.2.586.7 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Printed_part_template_terminal. There shall be one or more Connection_zone for a Printed_part_template_terminal. The Feature_shape_occurrence (see 4.2.316) specified by the terminal or mounting feature may be the same Feature_shape_occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is specified as the Connection_zone.

Constraints:

UR1: The combination of the name and the associated_definition shall be unique within a population of Printed_part_template_terminals.

WR1: The points comprising the attachment surface must reside in the shape of the electrical device being accessed.

WR2: The points comprising the terminal_connection_zone shall be defined in the coordinate system of the device being accessed via the terminal_connection_zone.

4.2.587 Printed_part_template_terminal_relationship

A Printed_part_template_terminal_relationship is a type of Managed_design_object (see 4.2.431). A Printed_part_template_terminal_relationship is an association between two Printed_part_template_terminal (see 4.2.586) in a Printed_part_template (see 5.2.4.355).

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The data associated with a Printed_part_template_terminal_relationship are the following:

— related_printed_part_terminal;

— relating_printed_part_terminal.

4.2.587.1 related_printed_part_terminal

The related_printed_part_terminal specifies the dependent Printed_part_template_terminal (see 4.2.586) in the Printed_part_template_terminal_relationship.

4.2.587.2 relating_printed_part_terminal

The relating_printed_part_terminal specifies the independent Printed_part_template_terminal (see 4.2.586) in the Printed_part_template_terminal_relationship.

4.2.588 Probe_access_area

A Probe_access_area is a type of Laminate_component (see 4.2.404). A Probe_access_area may be an Internal_probe_access_area (see 5.2.4.232). A Probe_access_area is a feature incorporated into the design of an Interconnect_module (see 4.2.372) for the purpose of measuring electrical characteristics of the design. It is realized by an exposed surface of conducting material that is in physical contact with the Conductor (see 5.2.4.162) or Conductive_filled_area (see 5.2.4.365) upon which the measurement is to be made.

EXAMPLE 1 Figure 96 illustrates a detail of a layout drawing that shows a probe area in the layout. Sufficient detail may be included in the design to evaluate accurately probe placement and volume restrictions.

The data associated with a Probe_access_area are the following:

— probe_contact_zone;

— probed_layout_item.

4.2.588.1 probe_contact_zone

The probe_contact_zone specifies the role of the Connection_zone (see 4.2.147) for the Probe_access_-area.

4.2.588.2 probed_layout_item

The probed_layout_item specifies the role of the Stratum_feature (see 4.2.683) for the Probe_access_-area.

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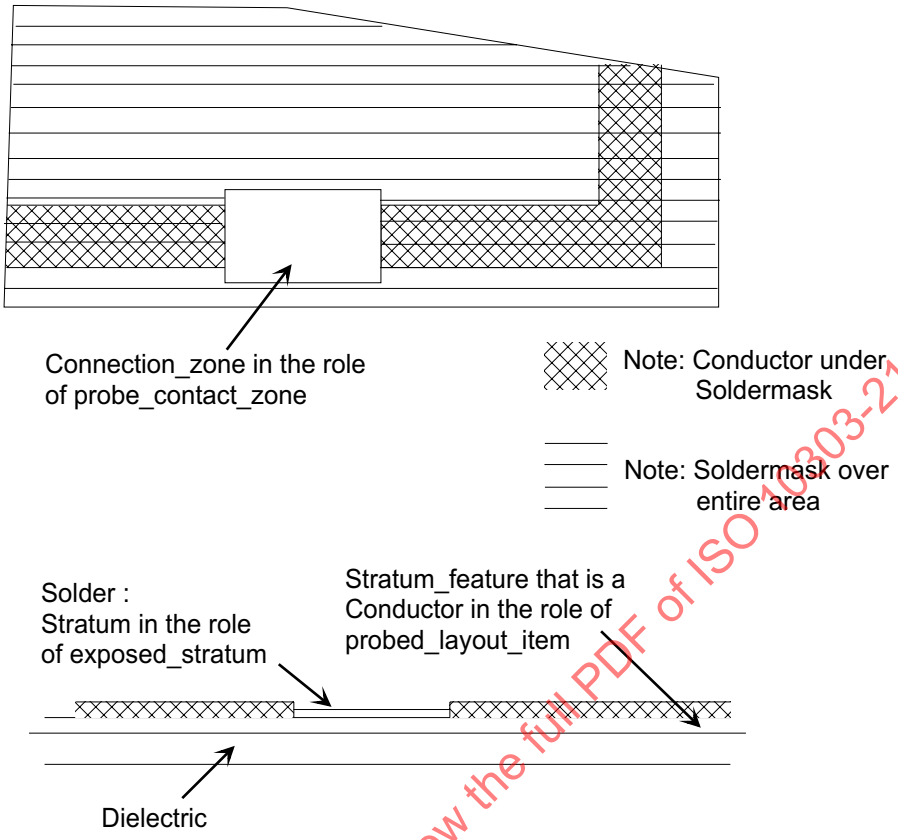

Figure 96 – Probe_access_area

4.2.589 Process_specification

A Process_specification is a type of Ee_specification (see 4.2.292) that identifies and describes an activity to be performed on an Ee_product (see 4.2.274) or Ee_material (see 4.2.273). A Process_specification may be an Assembly_technology_specification (see 4.2.42), a Fabrication_technology_specification (see 5.2.4.217) or a Lead_form_specification (see 5.2.4.357).

EXAMPLE 1 Figure 97 illustrates a detail from a Process_specification for an etching process.

4.2.590 Product_association

A Product_association is a type of Managed_design_object (see 4.2.431). A Product_association is a usage constraint relationship among some parts that may be used in a design. If the relating part is used in a design then the related parts must also be incorporated in the design and in a prescribed fashion.

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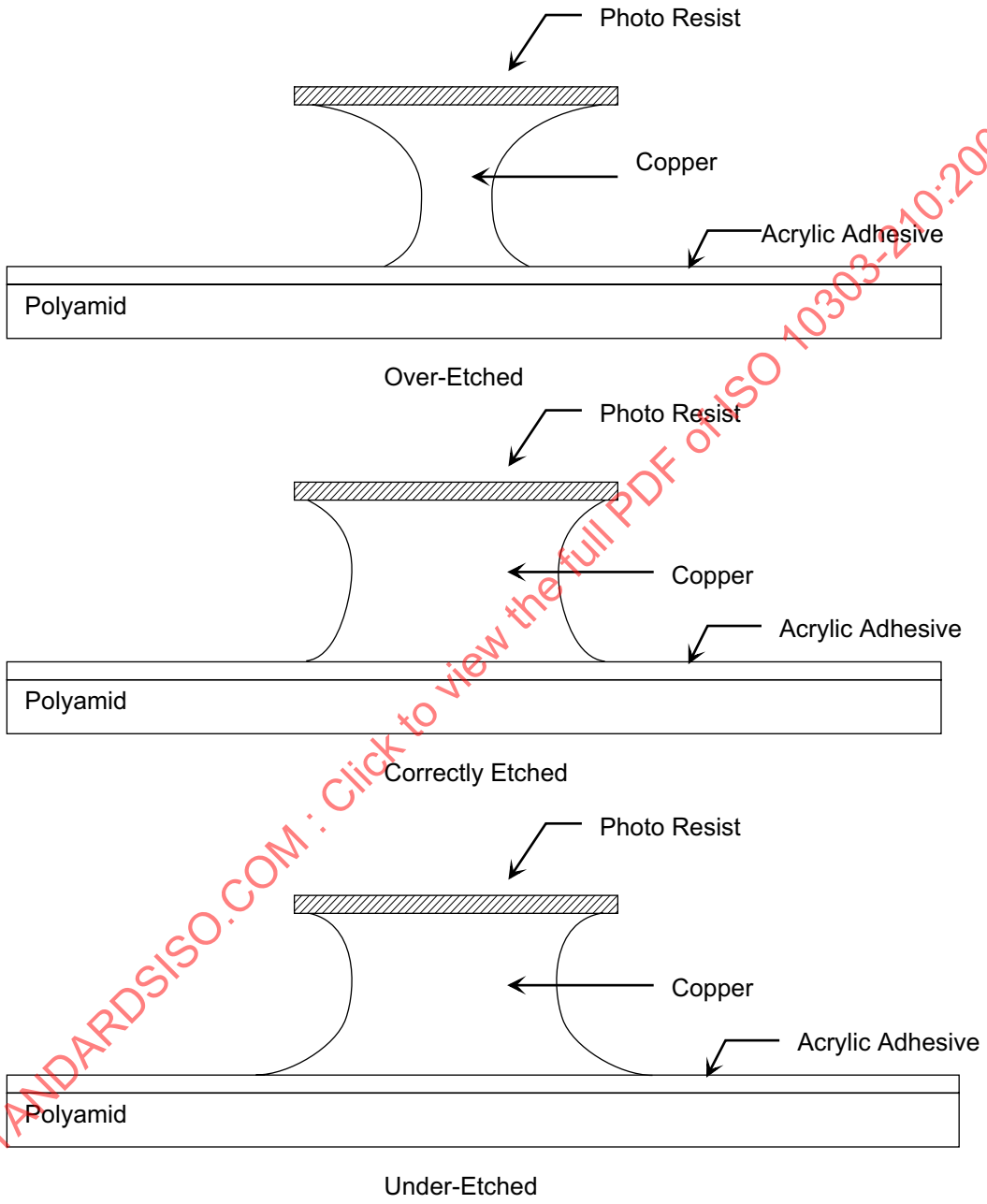

Figure 97 – Process_specification

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The data associated with a Product_association are the following:

— constraint_source;

— related_product;

— relating_product.

4.2.590.1 constraint_source

The constraint_source specifies the Ee_specification (see 4.2.292) that describes the manner in which Ee_product_version (see 4.2.282) that participate in the Product_association are to be used in the design.

4.2.590.2 related_product

The related_product specifies the Ee_product_version (see 4.2.282) that must be incorporated in the design when the relating_product is used in the design for the Product_association. There shall be one or more Ee_product_version for the Product_association.

4.2.590.3 relating_product

The relating_product specifies the Ee_product_version (see 4.2.282) that, when incorporated in the design, requires the incorporation of one or more related_product to be incorporated in the design to realize the desired functionality of the relating_product for the Product_association.

Constraints:

UR1: The constraint_source shall be unique within a population of Product_associations.

WR1: An Ee_product_version shall not be an ancestor or descendent of itself in a population of this object.

4.2.591 Profile_boundary_definition

A Profile_boundary_definition is a type of Boundary_zone_definition_with_specified_size (see 4.2.61) that characterizes a Tolerance_zone_boundary (see 4.2.734) of a Tolerance_zone (see 4.2.732) that is defined by either a Profile_of_any_line_tolerance (see 5.2.4.41) or a Profile_of_any_surface_tolerance (see 4.2.596). A Profile_boundary_definition may be a Profile_boundary_definition_with_offsets (see 4.2.592).

The data associated with a Profile_boundary_definition are the following:

— basic_profile;

— defined_zone_boundary.

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4.2.591.1 basic_profile

The basic_profile specifies the True_profile (see 4.2.753) that characterizes the theoretically exact profile of the toleranced Physical_feature_or_part_template (see 4.2.527) along which the Tolerance_zone_-opposing_boundary_set (see 4.2.745) is disposed.

4.2.591.2 defined_zone_boundary

The defined_zone_boundary specifies the Tolerance_zone_opposing_boundary_set (see 4.2.745) that is characterized by the Profile_boundary_definition. If a Tolerance_zone_implicit_boundary_set is specified as the defined_zone_boundary, the Tolerance_zone_boundary (see 4.2.734) is equally disposed about the True_profile (see 4.2.753).

Constraints:

WR1: The Tolerance_zone_definition specified as the zone_definition shall be specified as the tolerance_zone_or_boundary_definition by either a Profile_of_any_line_tolerance or a Profile_of_any_surface_tolerance.

4.2.592 Profile_boundary_definition_with_offsets

A Profile_boundary_definition_with_offsets is a type of Profile_boundary_definition (see 4.2.591) in which the offset of each Tolerance_zone_boundary_member (see 4.2.736) relative to the True_profile (see 4.2.753) is explicitly defined.

The data associated with a Profile_boundary_definition_with_offsets are the following:

— boundary_offsets;

— defined_zone_boundary.

4.2.592.1 boundary_offsets

The boundary_offsets specifies the Tolerance_zone_boundary_member_offset (see 4.2.737) for each Tolerance_zone_boundary_member (see 4.2.736) of the Tolerance_zone_explicit_opposing_boundary_set (see 4.2.742) specified as the defined_zone_boundary. Each Tolerance_zone_boundary_member_offset characterizes the offset of a Tolerance_zone_boundary_member from the True_profile (see 4.2.753). There shall be exactly two Tolerance_zone_boundary_member_offset specified as the boundary_offsets for the Profile_boundary_definition_with_offsets.

4.2.592.2 defined_zone_boundary

The defined_zone_boundary specifies the Tolerance_zone_explicit_opposing_boundary_set (see 4.2.742) that is characterized by the Profile_boundary_definition_with_offsets.

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Constraints:

WR1: The sum of each Length_data_element specified as the offset_value by the two Tolerance_zone_-boundary_member that are specified as the boundary_offsets shall equal the Length_data_element specified by the tolerance_value of the Boundary_size_characteristic specified as the specified_boundary_size.

WR2: The value of the label specified by the type_of_offset of one of the Tolerance_zone_boundary_-member_offsets specified by the boundary_offsets shall be "away_from_material".

WR3: The value of the label specified by the type_of_offset of one of the Tolerance_zone_boundary_-member_offsets specified by the boundary_offsets shall be "towards offset".

4.2.593 Profile_of_any_line_tolerance

A Profile_of_any_line_tolerance is a type of Geometric_tolerance (see 5.2.4.386). A Profile_of_any_-line_tolerance is either a Profile_of_any_line_tolerance_without_referenced_datum_system (see 5.2.4.401) or a Profile_of_any_line_tolerance_with_referenced_datum_system (see 5.2.4.156). A Profile_of_any_-line_tolerance may also be a Composite_linear_profile_refinement_tolerance (see 5.2.4.40). A Profile_-of_any_line_tolerance participates in the specification of a design requirement on the form, and possibly on the orientation, size, and location of line elements of a surface. The Profile_of_any_line_tolerance is similar to the Profile_of_any_surface_tolerance (see 4.2.596) in that the Tolerance_zone (see 4.2.732) is based on the True_profile (see 4.2.753). However, with a Profile_of_any_line_tolerance, each line element of the surface must lie within its associated Tolerance_zone, where the line elements are the cross-sections of the toleranced surface that are parallel to the specified Viewing_plane (see 4.2.769). If the design requirements are such that the Tolerance_zone_boundary (see 4.2.734) is unequally disposed about the True_profile, either unilaterally or bilateral, a Profile_boundary_definition_with_offsets (see 4.2.592) shall be used to specify this requirement.

NOTE Profile of any line tolerance is defined in terms of tolerance zone definitions in 14.5 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Physical_feature_or_-part_template.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Profile_of_any_line_tolerance shall not be a Geometric_tolerance_with_applied_material_-condition_property.

WR3: The Profile_of_any_line_tolerance shall specify as the tolerance_zone_or_boundary_definition a Tolerance_zone_definition that specifies a Profile_boundary_definition as its boundary_definition.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a profile of any line tolerance is sensible.

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4.2.594 Profile_of_any_line_tolerance_with_referenced_datum_system

A Profile_of_any_line_tolerance_with_referenced_datum_system is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) and a type of Profile_of_any_line_tolerance (see 5.2.4.41) in which the line elements of the toleranced Physical_feature_or_part_template (see 4.2.527) are oriented and/or located in relation to a Datum_system (see 5.2.4.316). A Profile_of_any_line_tolerance_with_referenced_datum_system may be a Composite_linear_profile_locating_tolerance (see 5.2.4.155).

4.2.595 Profile_of_any_line_tolerance_without_referenced_datum_system

A Profile_of_any_line_tolerance_without_referenced_datum_system is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) and a type of Profile_of_any_line_tolerance (see 5.2.4.41) in which the line elements of the toleranced Physical_feature_or_part_template (see 4.2.527) are not oriented and/or located in relation to a Datum_system (see 5.2.4.316). That is, it is a Profile_of_any_line_tolerance that specifies design requirements on the profile of line elements of the Shape_element (see 4.2.645) to which the Profile_of_any_line_tolerance_without_referenced_datum_system is applied, and in which the line elements are oriented parallel to a specified Viewing_plane (see 4.2.769) as opposed to oriented relative to a referenced Datum_system.

Constraints:

WR1: The Tolerance_zone_definition specified as the tolerance_zone_or_boundary_definition shall be a Tolerance_zone_definition_with_specified_orientation that specifies a Viewing_plane_based_orientation as its zone_orientation.

4.2.596 Profile_of_any_surface_tolerance

A Profile_of_any_surface_tolerance is a type of Geometric_tolerance (see 5.2.4.386) that specifies or partially specifies the design requirement on the form and possibly on the orientation, size, and location of a surface. A Profile_of_any_surface_tolerance is either a Profile_of_any_surface_tolerance_with_referenced_datum_system (see 4.2.597) or a Profile_of_any_surface_tolerance_without_referenced_datum_system (see 5.2.4.35). A Profile_of_any_surface_tolerance may also be a Composite_surface_profile_refinement_tolerance (see 5.2.4.334). The Profile_of_any_surface_tolerance defines a uniform Tolerance_zone_boundary (see 4.2.734) along the true profile of the surface within which the actual surface must lie. If the design requirements are such that the Tolerance_zone_boundary is unequally disposed about the True_profile (see 4.2.753), either unilaterally or bilateral, a Profile_boundary_definition_with_offsets (see 4.2.592) shall be used to specify this requirement.

NOTE Profile of any surface tolerance is defined in terms of tolerance zone definitions in 14.6 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Physical_feature_or_part_template.

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NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Profile_of_any_surface_tolerance shall not be a Geometric_tolerance_with_applied_material_condition_property.

WR3: The Profile_of_any_surface_tolerance shall specify as the tolerance_zone_or_boundary_definition a Tolerance_zone_definition that specifies a Profile_boundary_definition as its boundary_definition.

4.2.597 Profile_of_any_surface_tolerance_with_referenced_datum_system

A Profile_of_any_surface_tolerance_with_referenced_datum_system is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) and a type of Profile_of_any_surface_tolerance (see 4.2.596). That is, it is a type of Profile_of_any_surface_tolerance in which the Physical_feature_or_part_template (see 4.2.527) to which it is applied is oriented and/or located in relation to a Datum_system (see 5.2.4.316). A Profile_of_any_surface_tolerance_with_referenced_datum_system may be a Composite_surface_profile_locating_tolerance (see 5.2.4.333).

4.2.598 Profile_of_any_surface_tolerance_without_referenced_datum_system

A Profile_of_any_surface_tolerance_without_referenced_datum_system is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) and a type of Profile_of_any_surface_tolerance (see 4.2.596). That is, it is a Profile_of_any_surface_tolerance in which the Physical_feature_or_part_template (see 4.2.527) to which the Profile_of_any_surface_tolerance_without_referenced_datum is applied is not oriented or located in relation to a Datum_system (see 5.2.4.316).

4.2.599 Profile_related_positional_boundary

A Profile_related_positional_boundary is a type of Positional_boundary (see 4.2.561) that is a theoretical boundary that is defined by a Boundary_based_position_tolerance (see 4.2.59) in conjunction with a Profile_of_any_surface_tolerance (see 4.2.596). The Profile_of_any_surface_tolerance defines a Tolerance_zone (see 4.2.732) that is bounded by two Tolerance_zone_boundary_member (see 4.2.736). The Profile_related_positional_boundary is offset from one of these Tolerance_zone_boundary_member. The particular Tolerance_zone_boundary_member and the direction of offset are determined by the material conditions specified by the Boundary_based_position_tolerance. If the Boundary_based_position_tolerance is specified on a "maximum material principle" basis, then the Tolerance_zone_boundary_member from which the Profile_related_positional_boundary is offset is the one that is offset from the True_profile (see 4.2.753)"away from material". Similarly, if the Boundary_based_position_tolerance is specified on a "least material requirement" basis, then the Tolerance_zone_boundary_member from which the Profile_related_positional_boundary is offset is the one that is offset from the True_profile "towards material". The Profile_related_positional_boundary is offset from the Tolerance_zone_boundary_member in the same direction that the Tolerance_zone_boundary_member is offset from the True_profile.

The data associated with a Profile_related_positional_boundary are the following:

— associating_relationship.

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4.2.599.1 associating_relationship

The associating_relationship is an inverse relationship that specifies that the existence of the Profile_-related_positional_boundary is dependent on the existence of the Positional_boundary_and_profile_-boundary_member_relationship (see 4.2.562) that specifies the Profile_related_positional_boundary as its offset_positional_boundary.

Constraints:

WR1: The Positional_boundary_definition specified as the boundary_definition shall be a Profile_related_positional_boundary_definition.

NOTE The attribute boundary_definition is declared in the Positional_boundary entity of which this entity is a subtype.

4.2.600 Profile_related_positional_boundary_definition

A Profile_related_positional_boundary_definition is a type of Positional_boundary_definition (see 5.2.4.323) that characterizes a Profile_related_positional_boundary (see 4.2.599). A Profile_related_positional_-boundary_definition is defined by a Boundary_based_position_tolerance (see 4.2.59) in conjunction with a Profile_of_any_surface_tolerance (see 4.2.596).

The data associated with a Profile_related_positional_boundary_definition are the following:

— boundary_offset;

— defined_positional_boundary.

4.2.600.1 boundary_offset

The boundary_offset specifies the Positional_boundary_offset (see 4.2.566) that characterizes the offset of the Profile_related_positional_boundary (see 4.2.599) for the Profile_related_positional_boundary_-definition.

4.2.600.2 defined_positional_boundary

The defined_positional_boundary specifies the Profile_related_positional_boundary (see 4.2.599) that is characterized by the Profile_related_positional_boundary_definition.

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Constraints:

WR1: The Profile_related_positional_boundary specified as the offset_positional_boundary by the Positional_boundary_and_profile_boundary_member_relationship that is specified as the offset_boundary_relationship by the Positional_boundary_offset that is specified as the boundary_offset shall be the same instance of Profile_related_positional_boundary as specified as the defined_positional_boundary.

WR2: The Profile_related_positional_boundary_definition shall be specified by exactly one Geometric_tolerance as the tolerance_zone_or_boundary_definition, and that Geometric_tolerance shall be a Boundary_based_position_tolerance.

4.2.601 Projected_tolerance_zone_definition

A Projected_tolerance_zone_definition is a type of Tolerance_zone_definition (see 4.2.739) in which the Tolerance_zone (see 4.2.732) is projected from a Physical_feature_or_part_template (see 4.2.527) of the Physical_unit (see 4.2.533).

The data associated with a Projected_tolerance_zone_definition are the following:

— projected_zone_height.

4.2.601.1 projected_zone_height

The projected_zone_height specifies the Projected_zone_height_characteristic (see 4.2.603) that defines the height that the defined Tolerance_zone (see 4.2.732) is projected above a base Physical_feature_or_part_template (see 4.2.527).

Constraints:

WR1: The Tolerance_zone specified as the projected_zone of the Projected_zone_and_base_relationship that is specified as the defined_height_of of the projected_zone_height that is specified as the Projected_zone_height shall be the same instance of Projected_tolerance_zone as specified as the defined_tolerance_zone.

NOTE The attribute defined_tolerance_zone is declared in the Tolerance_zone_definition entity of which this entity is a subtype.

WR2: The Projected_tolerance_zone_definition shall be specified as the tolerance_zone_or_boundary_definition by exactly one Geometric_tolerance, and that Geometric_tolerance shall not be a Circularity_tolerance, a Cylindricity_tolerance, a Flatness_tolerance, a Straightness_tolerance, a Circular_runout_tolerance, a Total_runout_tolerance, a Profile_of_any_line_tolerance, a Profile_of_any_surface_tolerance, or a Boundary_based_position_tolerance.

WR3: The Projected_tolerance_zone_definition shall be specified as the tolerance_zone_or_boundary_definition by exactly one Geometric_tolerance, and that Geometric_tolerance shall specify either a Centre_axis, or Centre_plane as its toleranced_shape_element.

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4.2.602 Projected_zone_and_base_relationship

A Projected_zone_and_base_relationship is a type of Managed_design_object (see 4.2.431). A Projected_zone_and_base_relationship is a relationship that associates a Tolerance_zone (see 4.2.732) with the Physical_feature_or_part_template (see 4.2.527) from which the Tolerance_zone is projected.

The data associated with a Projected_zone_and_base_relationship are the following:

— base_physical_feature;

— projected_zone;

— size_characteristic.

4.2.602.1 base_physical_feature

The base_physical_feature specifies the Physical_feature_or_part_template (see 4.2.527) from which the Tolerance_zone (see 4.2.732) that is specified as the projected_zone is projected.

4.2.602.2 projected_zone

The projected_zone specifies the Tolerance_zone (see 4.2.732) that is projected from the Physical_feature_or_part_template (see 4.2.527) that is specified as the base_physical_feature.

4.2.602.3 size_characteristic

The size_characteristic is an inverse relationship that specifies that the existence of the Projected_zone_and_base_relationship is dependent on the existence of the Projected_zone_height_characteristic (see 4.2.603) that specifies the Projected_zone_and_base_relationship as its defined_height_of.

Constraints:

IP1: The Physical_feature_or_part_template specified as the base_physical_feature shall be a feature from which it is sensible to project a Tolerance_zone.

4.2.603 Projected_zone_height_characteristic

A Projected_zone_height_characteristic is a type of Managed_design_object (see 4.2.431). A Projected_zone_height_characteristic is a definition that characterizes the height that a Tolerance_zone (see 4.2.732) is projected from a Physical_feature_or_part_template (see 4.2.527).

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The data associated with a Projected_zone_height_characteristic are the following:

— defined_height_of;

— projected_height_value;

— zone_definition.

4.2.603.1 defined_height_of

The defined_height_of specifies the Projected_zone_and_base_relationship (see 4.2.602) that associates a Tolerance_zone (see 4.2.732) with the Physical_feature_or_part_template (see 4.2.527) from which the Tolerance_zone is projected. The specified Projected_zone_and_base_relationship is characterized by the Projected_zone_height_characteristic.

4.2.603.2 projected_height_value

The projected_height_value specifies the Length_data_element (see 4.2.422) that represents the height that the associated Tolerance_zone (see 4.2.732) is projected relative to the associated Physical_feature_or_part_template (see 4.2.527) for the Projected_zone_height_characteristic.

4.2.603.3 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Projected_zone_height_characteristic is dependent on the existence of the Projected_tolerance_zone_definition (see 4.2.601) that specifies the Projected_zone_height_characteristic as its projected_zone_height.

4.2.604 Promissory_usage_relationship

A Promissory_usage_relationship is a type of Managed_design_object (see 4.2.431). The Promissory_usage_relationship is the relationship of an item to a higher assembly where the next higher assembly of the item has not been defined.

EXAMPLE 1 A designer is designing an MCM that will be used on a board that will be part of a system. The designer does not yet know the next higher assembly for the MCM, since the board on which it will be placed has not yet been defined in the product structure for the system. The designer does, however, know the system in which the MCM will be used. Using the Promissory_usage_relationship, the designer can specify that the MCM is promised to be used within the system, without reference to the specific board on which it will reside.

The data associated with a Promissory_usage_relationship are the following:

— assembly;

— component;

— security_code.

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4.2.604.1 assembly

The assembly specifies the role of the Physical_unit_design_view (see 4.2.535) for the Promissory_-usage_relationship.

4.2.604.2 component

The component specifies the role of the Physical_unit (see 4.2.533) for the Promissory_usage_relationship.

4.2.604.3 security_code

The security_code specifies the role of the Security_classification (see 4.2.642) for the Promissory_-usage_relationship.

Constraints:

UR1: The combination of the component and the assembly shall be unique within a population of Promissory_usage_relationship.

4.2.605 Purpose_occurrence

A Purpose_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that specifies the intended behaviour and usage of the aspect of a design for which the requirement is allocated.

4.2.606 Qualified_data_element

A Qualified_data_element is a type of Data_element (see 4.2.173) in which there is an associated uncertainty. The uncertainty may be specified as precision, qualitative uncertainty, or expanded uncertainty, and the type of the related datum shall be included. The uncertainty is defined in clause 2 of "The Guide to the Expression of Uncertainty in Measurement".

4.2.607 Radius_edge_feature_shape

A Radius_edge_feature_shape is a type of Edge_shape (see 4.2.268) that describes a circular cross sectioned edge. See Bevel_edge_feature_shape (see 4.2.51) for the additional required geometric information that shall be provided.

EXAMPLE 1 Figure 98 illustrates the shape related information exchanged with this Application object.

The data associated with a Radius_edge_feature_shape are the following:

— maximum_radius_length;

— minimum_radius_length.

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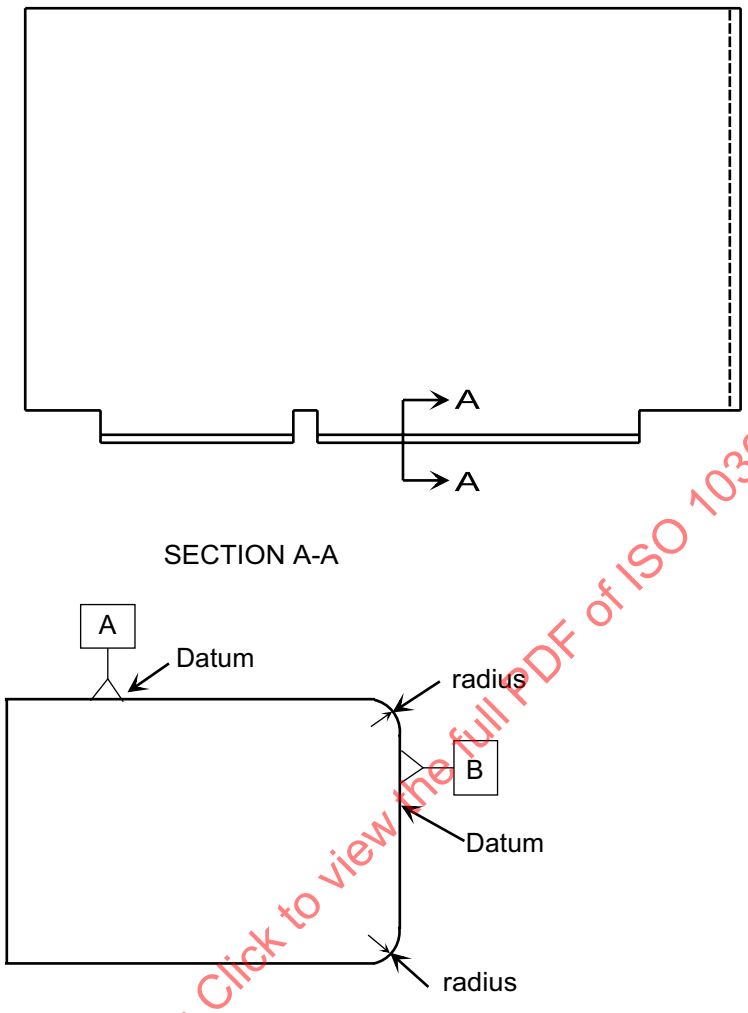

Figure 98 – Radius_edge_feature_shape

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4.2.607.1 maximum_radius_length

The maximum_radius_length specifies the Length_data_element (see 4.2.422) of the largest allowable radius of the circle that is tangent to the edge surface and to the lateral surface on which the edge surface is a feature for the Radius_edge_feature_shape. The included angle between the points of tangency shall always be 90 degrees.

4.2.607.2 minimum_radius_length

The minimum_radius_length specifies the Length_data_element (see 4.2.422) of the smallest allowable radius of the circle that is tangent to the edge surface and to the lateral surface on which the edge surface is a feature for the Radius_edge_feature_shape. The included angle between the points of tangency shall always be 90 degrees.

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4.2.608 Reference_composition_path

A Reference_composition_path is a type of Managed_design_object (see 4.2.431). A Reference_composition_path is one path through the function reference network graph.

The data associated with a Reference_composition_path are the following:

— path_element;

— reference_functional_unit.

4.2.608.1 path_element

The path_element specifies the role of the Functional_unit (see 5.2.4.313) for the Reference_composition_path. There shall be one or more Functional_unit for a Reference_composition_path.

4.2.608.2 reference_functional_unit

The reference_functional_unit specifies the Functional_unit (see 5.2.4.313) that participates as a link to the leaf node in the functional decomposition hierarchical definition in the Reference_composition_path.

4.2.609 Reference_functional_unit_assignment_to_part

A Reference_functional_unit_assignment_to_part is a type of Managed_design_object (see 4.2.431). A Reference_functional_unit_assignment_to_part assigns one specific path in the function reference network graph to an implementation. A Reference_functional_unit_assignment_to_part provides support for exchange of information needed to determine swappability of functions assigned to devices.

The data associated with a Reference_functional_unit_assignment_to_part are the following:

— functional_design_definition_path;

— implementation;

— of_property;

— path_alias;

— swap_code.

4.2.609.1 functional_design_definition_path

The functional_design_definition_path specifies the role of the Design_composition_path (see 4.2.223) for the Reference_functional_unit_assignment_to_part.

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4.2.609.2 implementation

The implementation specifies the role of the Physical_unit_usage_view (see 4.2.538) for the Reference_-functional_unit_assignment_to_part.

4.2.609.3 of_property

The of_property specifies the role of the Coordinated_characteristc for the Reference_functional_unit_-assignment_to_part. There may be more than one of_property for a Reference_functional_unit_assign-ment_to_part. The of_property need not be specified for a particular Reference_functional_unit_assign-ment_to_part.

4.2.609.4 path_alias

The path_alias specifies the string that is the identifier for the Reference_functional_unit_assignment_-to_part.

4.2.609.5 swap_code

The swap_code specifies the string that is the type of exchange that is valid.

Constraints:

UR1: The combination of the implementation and the path_alias shall be unique within a population of Reference_functional_unit_assignment_to_part.

4.2.610 Registered_font

A Registered_font is a type of Managed_design_object (see 4.2.431). A Registered_font is a font that is registered by an organization and defined within a document. Support shall be provided for font character representation using outline glyphs and font family exchange.

The data associated with a Registered_font are the following:

— font_code;

— registration_document.

4.2.610.1 font_code

The font_code specifies the string for the identifier of the Registered_font. The font_code shall be an entry in the registration_document.

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4.2.610.2 registration_document

The registration_document specifies the Ee_document (see 4.2.271) that contains the information about the Registered_font.

Constraints:

UR1: The combination of the font_code and the registration_document shall be unique within all members of a population of Registered_font.

4.2.611 Registered_style

A Registered_style is a type of Managed_design_object (see 4.2.431). A Registered_style is a description of a Package (see 4.2.466) that is recognized and utilized by manufacturers of Packaged_part (see 4.2.481).

EXAMPLE 1 Figure 99 illustrates cutaway details from package drawings to illustrate the pin forms.

The data associated with a Registered_style are the following:

— case_style_code;

— registration_document.

4.2.611.1 case_style_code

The case_style_code specifies the string used as a descriptive label that is understood as the identifier of the Registered_style. The case_style_code shall be an entry in the registration_document.

4.2.611.2 registration_document

The registration_document specifies the Ee_document (see 4.2.271) that describes the shape and other characteristics of the Registered_style.

Constraints:

UR1: The combination of the case_style_code and the registration_document shall be unique within all members of a population of Registered_style.

4.2.612 Representation

A Representation is a type of Managed_design_object (see 4.2.431). A Representation is a data set or function that may be human or computer interpretable.

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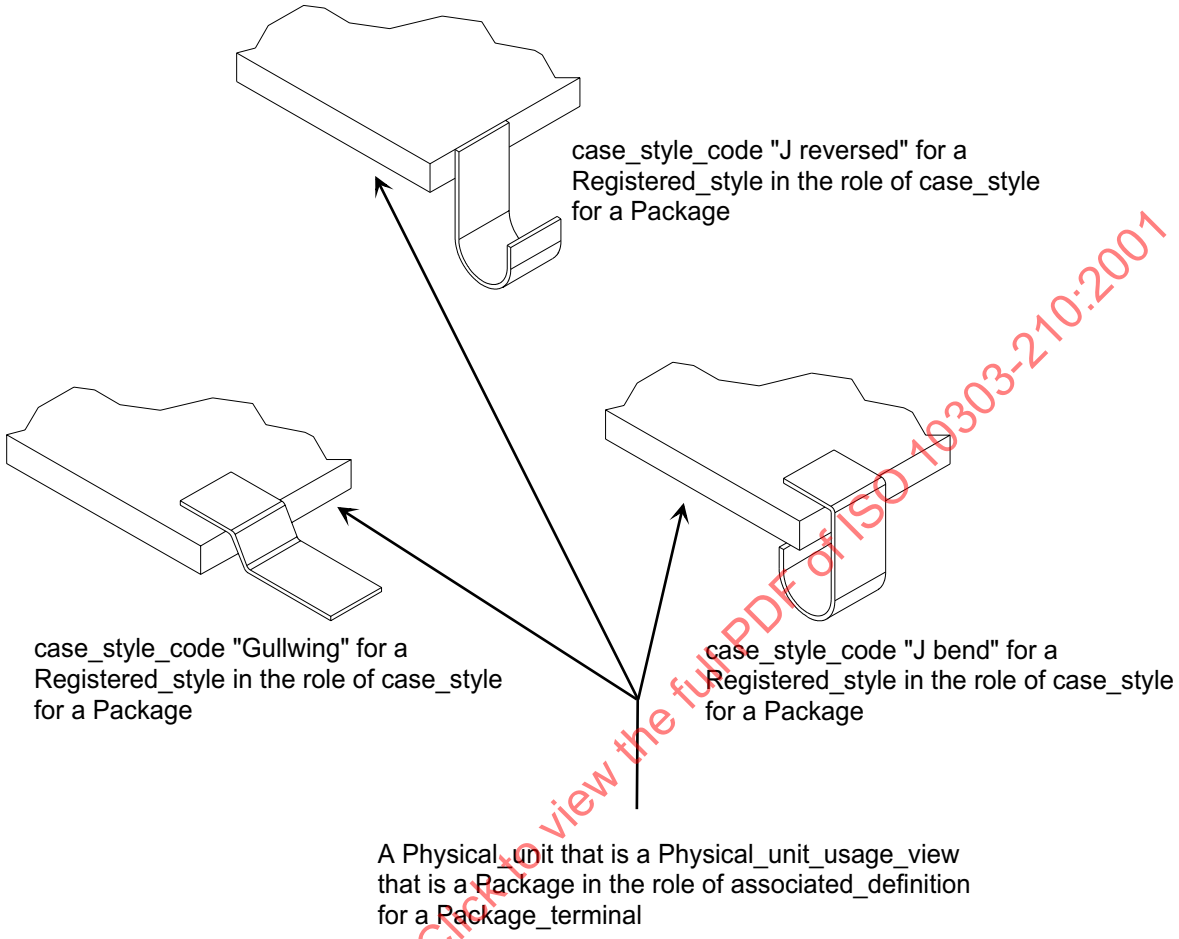

Figure 99 – Registered_style

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4.2.613 Requirement_allocation

A Requirement_allocation is a type of Managed_design_object (see 4.2.431). A Requirement_allocation is the allocation of requirement occurrences to the items in the product that meet the requirements.

The data associated with a Requirement_allocation are the following:

— allocated_requirement;

— target_product_object.

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4.2.613.1 allocated_requirement

The allocated_requirement specifies the Ee_requirement_occurrence (see 4.2.283) that is being allocated in the Requirement_allocation.

4.2.613.2 target_product_object

The target_product_object specifies either an Ee_product (see 4.2.274), an Ee_product_configuration (see 5.2.4.395), an Ee_product_definition (see 5.2.4.143), an Ee_product_version (see 4.2.282), a Part_feature (see 4.2.494), a Physical_connectivity_definition (see 5.2.4.1), or a Physical_connectivity_element (see 4.2.523), or one of an Assembly_component (see 4.2.27), a Component_external_reference (see 4.2.89), a Component_feature (see 4.2.90), a Component_feature_external_reference (see 4.2.91), an Ee_requirement_occurrence (see 4.2.283), a Stratum (see 4.2.677), or one of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) as the target for the Requirement_allocation. There shall be one or more Ee_product, Ee_product_configuration, Ee_product_definition, Ee_product_version, Part_feature, Physical_connectivity_definition, Assembly_component, Component_external_reference, Component_feature, Component_feature_external_reference, Ee_requirement_occurrence, Stratum, Inter_stratum_feature, Laminate_component, Stratum_feature, or Stratum_surface for the Requirement_allocation.

4.2.614 Requirement_composition

A Requirement_composition is a type of Managed_design_object (see 4.2.431). A Requirement_composition helps to compose an aggregation of Ee_requirement_occurrence (see 4.2.283) into a group in order to construct a requirements structure.

EXAMPLE 1 A requirements table is a typical example of a requirements structure.

EXAMPLE 2 A Requirement_composition would be used to convey an aggregate requirement that is the result of combining two requirements.

The data associated with a Requirement_composition are the following:

— composition;

— element.

4.2.614.1 composition

The composition specifies the Requirement_group_occurrence (see 5.2.4.331) for the aggregation for the Requirement_composition.

4.2.614.2 element

The element specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Requirement_composition. There shall be one or more Ee_requirement_occurrence for a Requirement_composition.

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4.2.615 Requirement_group_occurrence

A Requirement_group_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that is a collection of requirements, aggregated by providing one or more Requirement_composition.

4.2.616 Restraint_condition

A Restraint_condition is a type of Managed_design_object (see 4.2.431). A Restraint_condition is the specification of a requirement on the restraining conditions applied either to a Datum_feature (see 4.2.188) or a Physical_feature_or_part_template (see 4.2.527) during the verification of one or more Geometric_tolerance (see 5.2.4.386) or Dimensional_characteristic (see 4.2.256). The Restraint_condition may be a Tolerance_specific_restraint_condition (see 4.2.731). If the Restraint_condition is not a Tolerance_specific_restraint_condition, the Restraint_condition is a requirement for all instances of Geometric_tolerance and Dimensional_characteristic with the exception of those instances of Geometric_tolerance that have a Pre_defined_geometric_tolerance_qualifier (see 5.2.4.233) applied to them that have a description of "FREE_STATE", and those instances of Dimensional_characteristic that have a Pre_defined_dimension_qualifier (see 5.2.4.349) applied to them that have a description of "FREE_STATE".

The data associated with a Restraint_condition are the following:

— applied_to;

— restraint_description.

4.2.616.1 applied_to

The applied_to specifies either a Physical_feature_or_part_template (see 4.2.527) or a Datum_feature_usage_in_datum_relationship (see 5.2.4.132). If the applied to specifies a Physical_feature_or_part_template, it is on that Physical_feature_or_part_template that the restraint requirement is applied. If a Datum_feature_usage_in_datum_relationship is specified as the applied_to, the Restraint_condition specifies a restraint requirement on the relationship between the Datum_feature (see 4.2.188) and the Datum (see 4.2.176) specified by the Datum_feature_usage_in_datum_relationship.

4.2.616.2 restraint_description

The restraint_description specifies the Ee_requirement_occurrence (see 4.2.283) that describes how the restraint shall be applied.

EXAMPLE 1 The Restraint_condition might specify the torque to apply to bolts to secure Datum_feature (see 4.2.188)"A" to inspection equipment that simulates Datum (see 4.2.176)"A".

4.2.617 Right_angular_wedge

A Right_angular_wedge is a type of Csg_primitive (see 4.2.163) which is used in forming a "CSG" solid model.

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4.2.618 Right_circular_cylinder

A Right_circular_cylinder is a type of Csg_primitive (see 4.2.163) which is used in forming a "CSG" solid model.

4.2.619 Routed_interconnect_component

A Routed_interconnect_component is a type of Assembly_component (see 4.2.27). The functionality of a Routed_interconnect_component shall be that of a short.

The data associated with a Routed_interconnect_component are the following:

— routed_shape.

EXAMPLE 1 An example of a Routed_interconnect_component is a jumper wire. A jumper wire does not have a predefined placement or shape for its terminal. The shape of a jumper wire is not predefined. The predefined shapes in this example would be those shapes defined in a library.

4.2.619.1 routed_shape

The routed_shape specifies the role of the Feature_shape_definition (see 4.2.315) for the Routed_interconnect_component.

Constraints:

WR1: All terminals defined for the Routed_interconnect_component shall be equipotential with respect to the same reference potential.

4.2.620 Routed_packaged_component

A Routed_packaged_component is a type of Packaged_component (see 4.2.475). The layout shape of the Routed_packaged_component is not predefined. Limits to the shape variation permitted in a design are specified in the Packaged_part (see 4.2.481) technical data.

EXAMPLE 1 An example of Routed_packaged_component is a coaxial cable whose routed shape is specified in the assembly. The coaxial cable is not preformed for this placement. A product model would define the maximum and minimum delivered length and cable diameter, and allowed minimum bend radius, which would limit the shape permitted in the design. This part of ISO 10303 does not standardize these characteristics. The terminals of the coaxial cable would also be defined in the Packaged_part model.

The data associated with a Routed_packaged_component are the following:

— routed_shape.

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4.2.620.1 routed_shape

The routed_shape specifies the Feature_shape_definition (see 4.2.315) of the Routed_packaged_component.

4.2.621 Routed_printed_component

A Routed_printed_component is a type of Laminate_component (see 4.2.404).

The data associated with a Routed_printed_component are the following:

— component_extent;

— routed_shape;

— usage_definition.

EXAMPLE 1 An example of a Routed_printed_component is a meandering stripline.

4.2.621.1 component_extent

The component_extent specifies the role of the Inter_stratum_extent (see 5.2.4.83) for the Routed_printed_component.

4.2.621.2 routed_shape

The routed_shape specifies the role of the Feature_shape_definition (see 4.2.315) for the Routed_printed_component. The routed_shape may be represented as the result of an extrusion process, where the usage_definition is extruded along the path of the route.

NOTE This representation is not intended to reflect physical processing.

NOTE Usually there is one stratum_feature_implementation for each Design_layer_stratum used in the implementation.

4.2.621.3 usage_definition

The usage_definition specifies the role of the Printed_part_cross_section_template (see 4.2.579) for the Routed_printed_component. The usage_definition provides a cross-sectional definition that shall be interpreted as a constant cross-section along the path of the route.

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4.2.622 Rule_action

A Rule_action is a type of Managed_design_object (see 4.2.431). A Rule_action is one of a Rule_-adoption (see 4.2.623), a Rule_change_request (see 4.2.624), a Rule_creation (see 4.2.625), a Rule_-expiration (see 4.2.626), a Rule_modification (see 4.2.628), a Rule_rejection (see 4.2.630), a Rule_-request (see 4.2.631), a Rule_submission (see 4.2.634), or a Rule_supersedence (see 4.2.635). A Rule_-action is an assertion that some action has occurred toward management of rules.

The data associated with a Rule_action are the following:

— subject_action_assignment;

— subject_rule.

4.2.622.1 subject_action_assignment

The subject_action_assignment specifies the role of the Participant_date_and_time_assignment (see 4.2.508) for the Rule_action.

4.2.622.2 subject_rule

The subject_rule specifies the Ee_rule_version (see 5.2.4.234) as the version of an Ee_rule (see 5.2.4.51) for which some management Rule_action has occurred.

Constraints:

UR1: The combination of the subject_action_assignment and the subject_rule shall be unique within a population of Rule_actions.

4.2.623 Rule_adoption

A Rule_adoption is a type of Rule_action (see 5.2.4.92) that states a version of an Ee_rule (see 5.2.4.51) has been adopted.

4.2.624 Rule_change_request

A Rule_change_request is a type of Rule_action (see 5.2.4.92) that states a request has been made for modification to a version of an Ee_rule (see 5.2.4.51). The change reason shall be provided as a part of the Rule_change_request.

The data associated with a Rule_change_request are the following:

— change_reason.

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4.2.624.1 change_reason

The change_reason specifies the human-interpretable reason for requesting a Rule_change_request.

4.2.625 Rule_creation

A Rule_creation is a type of Rule_action (see 5.2.4.92) that states that a version of an Ee_rule (see 5.2.4.51) has been created.

4.2.626 Rule_expiration

A Rule_expiration is a type of Rule_action (see 5.2.4.92) that states that a version of an Ee_rule (see 5.2.4.51) has expired.

The data associated with a Rule_expiration are the following:

— expiration_rationale.

4.2.626.1 expiration_rationale

The expiration_rationale specifies the human-interpretable reason for the Rule_expiration.

4.2.627 Rule_justification

A Rule_justification is a type of Managed_design_object (see 4.2.431). A Rule_justification is the justification for an Ee_rule (see 5.2.4.51).

The data associated with a Rule_justification are the following:

— justification_rationale;

— justified_action.

4.2.627.1 justification_rationale

The justification_rationale specifies the text that describes the Rule_justification.

4.2.627.2 justified_action

The justified_action specifies the Rule_action (see 5.2.4.92) that results from the Rule_justification.

4.2.628 Rule_modification

A Rule_modification is a type of Rule_action (see 5.2.4.92) that states a version of an Ee_rule (see 5.2.4.51) is a result of a request to change an existing version of an Ee_rule.

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The data associated with a Rule_modification are the following:

— modification_rationale.

4.2.628.1 modification_rationale

The modification_rationale specifies the role of the Rule_change_request (see 4.2.624) for the Rule_-modification.

4.2.629 Rule_priority

A Rule_priority is a type of Managed_design_object (see 4.2.431). A Rule_priority is a statement that an Ee_rule (see 5.2.4.51) has priority over another Rule.

The data associated with a Rule_priority are the following:

— prioritized_rule;

— priority.

4.2.629.1 prioritized_rule

The prioritized_rule specifies the role of the Ee_rule_version (see 5.2.4.234) for the Rule_priority.

4.2.629.2 priority

The priority specifies the integer for the priority number of the Rule_priority. The lowest numeric value shall have the highest priority.

Constraints:

WR1: A number less than zero shall not be allowed.

4.2.630 Rule_rejection

A Rule_rejection is a type of Rule_action (see 5.2.4.92) that states a version of an Ee_rule (see 5.2.4.51) has been rejected. The rejection rationale shall be part of the Rule_rejection.

The data associated with a Rule_rejection are the following:

— rejection_reason.

4.2.630.1 rejection_reason

The rejection_reason specifies the human-interpretable explanation for the Rule_rejection.

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4.2.631 Rule_request

A Rule_request is a type of Rule_action (see 5.2.4.92) that states a version of an Ee_rule (see 5.2.4.51) has been requested. The rationale for the version shall be part of the Rule_request.

4.2.632 Rule_set

A Rule_set is a type of Managed_design_object (see 4.2.431). A Rule_set may be a Rule_set_group (see 4.2.633). A Rule_set is an association among Ee_rule (see 5.2.4.51) with Rule_priority (see 4.2.629).

The data associated with a Rule_set are the following:

— identifier;

— purpose;

— rule_priority_member.

4.2.632.1 identifier

The identifier specifies the human-interpretable identification for the Rule_set.

4.2.632.2 purpose

The purpose specifies the human-interpretable string for the purpose for the Rule_set.

4.2.632.3 rule_priority_member

The rule_priority_member specifies the role of the Rule_priority (see 4.2.629) for the Rule_set. There shall be one or more Rule_priority for the Rule_set.

Constraints:

UR1: The identifier shall be unique within a population of Rule_sets.

4.2.633 Rule_set_group

A Rule_set_group is a type of Rule_set (see 4.2.632). A Rule_set_group shall have at least two Rule_sets.

The data associated with a Rule_set_group are the following:

— elements.

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4.2.633.1 elements

The elements specify the Rule_set (see 4.2.632) for the Rule_set_group. There may be more than two Rule_set for the Rule_set_group.

4.2.634 Rule_submission

A Rule_submission is a type of Rule_action (see 5.2.4.92) stating that a version of an Ee_rule (see 5.2.4.51) has been submitted.

The data associated with a Rule_submission are the following:

— submission_rationale.

4.2.634.1 submission_rationale

The submission_rationale specifies the text that describes the rationale for the Rule_submission.

4.2.635 Rule_supersedence

A Rule_supersedence is a type of Rule_action (see 5.2.4.92) stating that one Ee_rule_version (see 5.2.4.234) has been superseded by another Ee_rule_version. Both shall be versions of the same Ee_-rule (see 5.2.4.51).

The data associated with a Rule_supersedence are the following:

— superseded_rule.

4.2.635.1 superseded_rule

The superseded_rule specifies the Ee_rule_version (see 5.2.4.234) that has been superseded for the Rule_supersedence.

Constraints:

WR1: The Ee_rule in the role of configuration_managed_rule for the Ee_rule_version in the role of superseded_rule specified by this Rule_supersedence shall be the same Ee_rule that is in the role of configuration_managed_rule inherited from the supertype Rule_action that is specified by this Rule_-supersedence.

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4.2.636 Runout_tolerance_zone_definition_with_specified_angle

A Runout_tolerance_zone_definition_with_specified_angle is a type of Tolerance_zone_definition (see 4.2.739) that is defined by either a Circular_runout_tolerance (see 4.2.78) or a Total_runout_tolerance (see 5.2.4.398), and in which the Tolerance_zone (see 4.2.732) is oriented with respect to a Directed_axis (see 5.2.4.61). The Directed_axis is coincident with the Datum_axis (see 4.2.177) about which the Tolerance_zone is centred.

NOTE Circular run-out tolerance in a specified direction is described in 14.13.4 of ISO 1101.

The data associated with a Runout_tolerance_zone_definition_with_specified_angle are the following:

— runout_orientation.

4.2.636.1 runout_orientation

The runout_orientation specifies the Runout_zone_orientation (see 4.2.638) that defines the orientation of the Tolerance_zone (see 4.2.732) relative to a specified Directed_axis (see 5.2.4.61) for the Runout_tolerance_zone_definition_with_specified_angle.

Constraints:

WR1: The Tolerance_zone specified as the oriented_zone by the Runout_tolerance_zone_orienting_relationship that is specified as the oriented_relationship by the Runout_zone_orientation that is specified as the runout_orientation, shall be the same instance of Tolerance_zone as specified as the defined_tolerance_zone.

WR2: The Runout_tolerance_zone_definition_with_specified_angle shall be specified as the tolerance_zone_or_boundary_definition by exactly one Geometric_tolerance, and that Geometric_tolerance shall be either a Circular_runout_tolerance or a Total_runout_tolerance.

WR3: The instance of Centre_axis specified as the axis_to_be_oriented by the Directed_axis to which the Tolerance_zone is oriented shall be a Datum_axis that is in the Datum_system the definition of which is specified as the datum_system_definition by the associated Circular_runout_tolerance or Total_runout_tolerance.

4.2.637 Runout_tolerance_zone_orienting_relationship

A Runout_tolerance_zone_orienting_relationship is a type of Managed_design_object (see 4.2.431). A Runout_tolerance_zone_orienting_relationship is a relationship that associates a Tolerance_zone (see 4.2.732) with the Directed_axis (see 5.2.4.61) with which it is oriented.

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The data associated with a Runout_tolerance_zone_orienting_relationship are the following:

— angular_size_characteristic;

— oriented_zone;

— orienting_axis.

4.2.637.1 angular_size_characteristic

The angular_size_characteristic is an inverse relationship that specifies that the existence of the Runout_tolerance_zone_orienting_relationship is dependent on the existence of the Runout_zone_orientation (see 4.2.638) that specifies the Runout_tolerance_zone_orienting_relationship as its oriented_relationship.

4.2.637.2 oriented_zone

The oriented_zone specifies the Tolerance_zone (see 4.2.732) that is oriented with respect to the specified Directed_axis (see 5.2.4.61) by the Runout_tolerance_zone_orienting_relationship.

4.2.637.3 orienting_axis

The orienting_axis specifies the Directed_axis (see 5.2.4.61) to which the specified Tolerance_zone (see 4.2.732) is oriented by the Runout_tolerance_zone_orienting_relationship.

Constraints:

IP1: The Centre_axis upon which the Directed_axis is based shall correspond with the axis upon which the unit would be rotated if the corresponding run-out tolerance (i.e., either a Circular_runout_tolerance or Total_runout_tolerance) were to be verified.

4.2.638 Runout_zone_orientation

A Runout_zone_orientation is a type of Managed_design_object (see 4.2.431). A Runout_zone_orientation is a definition that characterizes the orientation between a Tolerance_zone (see 4.2.732) and a Directed_axis (see 5.2.4.61) that is coincident with the Datum_axis (see 4.2.177) about which the Tolerance_zone is centred.

The data associated with a Runout_zone_orientation are the following:

— oriented_relationship;

— semi_angle_value;

— zone_definition.

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4.2.638.1 oriented_relationship

The oriented_relationship specifies the Runout_tolerance_zone_orienting_relationship (see 4.2.637) that associates the Tolerance_zone (see 4.2.732) with the Directed_axis (see 5.2.4.61) with which the Tolerance_zone is oriented, and that is characterized by the Runout_zone_orientation.

4.2.638.2 semi_angle_value

The semi_angle_value specifies the Angle_data_element (see 4.2.17) that represents the size of the angle between the Tolerance_zone (see 4.2.732) and the Directed_axis (see 5.2.4.61).

4.2.638.3 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Runout_zone_orientation is dependent on the existence of the Runout_tolerance_zone_definition_with_specified_angle (see 4.2.636) that specifies the Runout_zone_orientation as its runout_orientation.

4.2.639 Scalar_terminal_definition

A Scalar_terminal_definition is a type of Functional_unit_usage_view_terminal_definition (see 5.2.4.306) for which the size shall be unity.

The data associated with a Scalar_terminal_definition are the following:

— size.

4.2.639.1 size

The size specifies the cardinality for which the only allowed value shall be 1.

4.2.640 Seating_plane

A Seating_plane is a type of Non_feature_shape_element (see 5.2.4.127) included specifically for the purpose of providing a description of an interface plane. One primary usage in that purpose is synchronizing the two-dimensional and three-dimensional models of a package. The seating plane simulates a mating feature when referenced as an interfac_plane. The seating plane simulates the interconnect substrate surface in the definition view of a package, where it is referenced in the role of a seating_plane. When represented by a three-dimensional plane the normal shall represent the mating surface. The normal vector shall be in the Z axis and shall be at the origin of the defining coordinate system for the three-dimensional case.

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4.2.641 Secondary_orientation_feature

A Secondary_orientation_feature is either a Part_feature (see 4.2.494) or a Datum_feature (see 4.2.188). A secondary_orientation_feature provides anti-rotation capability for unambiguous orientation of the part in the datum_reference_frame.

The data associated with a Secondary_orientation_feature are the following:

— associated_body_vertical_extent.

4.2.641.1 associated_body_vertical_extent

An associated_body_vertical_extent specifies the role of the Package_body_surface (see 4.2.469) for a Secondary_orientation_feature. The associated_body_vertical_extent helps to identify the surface or surfaces which contain the feature. An associated_body_vertical_extent need not be specified for a Secondary_orientation_feature.

4.2.642 Security_classification

A Security_classification is a type of Managed_design_object (see 4.2.431). A Security_classification is the level of confidentiality that is required for the purpose of product data protection.

The data associated with a Security_classification are the following:

— classification_date;

— classification_officer;

— declassification_date;

— security_classification_approval.

4.2.642.1 classification_date

The classification_date specifies either the effective Date (see 4.2.174) or the effective Date_and_time (see 4.2.175) for the Security_classification.

4.2.642.2 classification_officer

The classification_officer specifies the Person (see 5.2.4.251) responsible for the Security_classification.

4.2.642.3 declassification_date

The declassification_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) upon which the Security_classification no longer applies. The declassification_date need not be provided for a particular Security_classification.

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4.2.642.4 security_classification_approval

The security_classification_approval specifies the role of the Ee_approval (see 4.2.269) for the Security_-classification.

4.2.643 Separate_geometric_tolerance_requirement

A Separate_geometric_tolerance_requirement is a type of Managed_design_object (see 4.2.431). A Separate_geometric_tolerance_requirement is a specification that indicates that a set of one or more Geometric_tolerance_with_referenced_datum_system (see 4.2.357) is to be treated as a separate requirement. That is, when geometric tolerances (excluding the composite profile refinement tolerances and composite feature relating position tolerances) reference the same datum system, all the physical features to which the geometric tolerances are applied are treated as a single pattern with regard to the geometric tolerances. If this type of interrelationship is not desired, the Separate_geometric_tolerance_requirement may be used to specify a set of one or more Geometric_tolerance (see 5.2.4.386) that are to be treated as a separate requirement.

NOTE Separate requirements are discussed in 4.5.12 of ASME Y14.5M.

The data associated with a Separate_geometric_tolerance_requirement are the following:

— separated_geometric_tolerances.

4.2.643.1 separated_geometric_tolerances

The separated_geometric_tolerances specifies the Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that are to be treated as a separate requirement. There shall be one or more Geometric_-tolerances_with_referenced_datum_system for a Separate_geometric_tolerance_requirement.

NOTE If the goal is for an individual Geometric_tolerance to be a separate requirement, then it should be specified as the separated_geometric_tolerances by a Separate_geometric_tolerance_requirement that only specifies that Geometric_tolerance.

Constraints:

WR1: The Geometric_tolerance_with_referenced_datum_system that are specified as the separated_-geometric_tolerances shall all specify the same instance of Datum_system_defining_conditions as their datum_system_definition.

WR2: The Geometric_tolerance_with_referenced_datum_system that are specified as the separated_-geometric_tolerances shall not either be Composite_linear_profile_refinement_tolerance, Composite_-surface_profile_refinement_tolerance, or Composite_feature_relating_position_tolerance.

WR3: The Geometric_tolerance_with_referenced_datum_system that are specified as the separated_-geometric_tolerances shall either be Profile_of_any_line_tolerance, Profile_of_any_surface_tolerance, or Position_tolerance.

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4.2.644 Shape_dimension_representation

A Shape_dimension_representation is a type of Managed_design_object (see 4.2.431). A Shape_dimension_representation is one of an Externally_defined_dimension_representation (see 5.2.4.202), a Limit_dimension_representation (see 5.2.4.358), a Plus_minus_tolerance_range_representation (see 4.2.556), or a Singular_dimension_representation (see 4.2.663). A Shape_dimension_representation is a representation of a Dimensional_characteristic (see 4.2.256). The Shape_dimension_representation explicitly describes one or more Dimensional_characteristic with a single value, a range of values, a combination of values, or values and references to the standard documents that define the meaning of these values.

Constraints:

WR1: The Shape_dimension_representation shall be specified as a representation of at least one Dimensional_characteristic_representation.

4.2.645 Shape_element

A Shape_element is a type of Managed_design_object (see 4.2.431). A Shape_element is one of a Non_feature_shape_element (see 5.2.4.127) or a Physical_feature_or_part_template (see 4.2.527), or additionally is a Composite_shape_element (see 5.2.4.125). A Shape_element is an identifiable element of the shape of a Physical_unit (see 4.2.533).

The data associated with a Shape_element are the following:

— description;

— name.

4.2.645.1 description

The description specifies the label that conveys the nature of the Shape_element. The description need not be specified for a Shape_element.

4.2.645.2 name

The name specifies the identifier of the Shape_element.

4.2.646 Shape_element_boundary_relationship

A Shape_element_boundary_relationship is a type of Shape_element_relationship (see 5.2.4.169) that specifies that a Shape_element (see 4.2.645) is the boundary or a portion of the boundary of another Shape_element. The related_shape_element specifies the Shape_element that is the boundary or a portion of a boundary of the Shape_element specified as the relating_shape_element.

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NOTE 1 The attribute related_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

NOTE 2 The attribute relating_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

EXAMPLE 1 A Shape_element_boundary_relationship may be used to specify that a Shape_element is one of the boundaries of a rectangular Datum_target (see 5.2.4.66) area. The boundary may then be located relative to a Datum (see 4.2.176) with a Dimensional_location (see 4.2.258).

Constraints:

WR1: The Shape_element specified as the relating_shape_element shall not be specified as a boundary of itself either directly or through intermediate Shape_element_boundary_relationship.

4.2.647 Shape_element_composing_relationship

A Shape_element_composing_relationship is a type of Shape_element_constituent_relationship (see 4.2.648) that associates a Composite_shape_element (see 5.2.4.125) with a Shape_element (see 4.2.645) from which the Composite_shape_element is composed.

The data associated with a Shape_element_composing_relationship are the following:

— relating_shape_element.

4.2.647.1 relating_shape_element

The relating_shape_element specifies the Composite_shape_element (see 5.2.4.125) that is the Shape_-element (see 4.2.645) that is composed from the Shape_element specified as the related_shape_element for the Shape_element_composing_relationship.

NOTE The attribute related_shape_element is declared in the entity Shape_element_relationship of which this entity is a subtype.

4.2.648 Shape_element_constituent_relationship

A Shape_element_constituent_relationship is a type of Shape_element_relationship (see 5.2.4.169) that associates a Shape_element (see 4.2.645) with a second Shape_element to which the first Shape_element is a constituent. The Shape_element that is the constituent Shape_element is specified as the related_-shape_element. The Shape_element to which the constituent Shape_element is a constituent is specified as the relating_shape_element. A Shape_element_constituent_relationship may be a Shape_element_-composing_relationship (see 5.2.4.242).

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NOTE 1 The attribute relating_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

NOTE 2 The attribute related_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

NOTE 3 The difference between a Shape_element_constituent_relationship and a Shape_element_composing_-relationship is that the Shape_element_constituent_relationship is used to indicate that a Shape_element is part of another Shape_element. However, the Shape_element_composing_relationship is used to completely specify the composition of a Composite_shape_element.

EXAMPLE 1 A Shape_element_constituent_relationship might be used to indicate that a Datum_target is on the bottom surface of a printed circuit board. In this case, the Shape_element that is the Datum_target would be specified as the related_shape_element, and the Shape_element that is the bottom surface of the printed circuit board would be specified as the relating_shape_element.

Constraints:

UR1: The combination of the relating_shape_element inherited from Shape_element_relationship and related_shape_element inherited from Shape_element_relationship shall be unique within a population of Shape_element_constituent_relationship. That is, any specific Shape_element shall not be a constituent of any one Shape_element more than once.

WR1: The Shape_element that is specified as the relating_shape_element shall not be a constituent of itself, either directly or indirectly.

4.2.649 Shape_element_deriving_relationship

A Shape_element_deriving_relationship is a type of Shape_element_relationship (see 5.2.4.169) that associates a Derived_shape_element (see 4.2.221) with a Shape_element (see 4.2.645) from which the Derived_shape_element is derived.

The data associated with a Shape_element_deriving_relationship are the following:

— relating_shape_element.

4.2.649.1 relating_shape_element

The relating_shape_element specifies the Derived_shape_element (see 4.2.221) that is the Shape_element (see 4.2.645) that is derived from the Shape_element specified as the related_shape_element for the Shape_element_deriving_relationship.

NOTE The attribute related_shape_element is declared in the Shape_element_relationship entity of which this entity is a subtype.

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EXAMPLE 1 Consider a centre axis that is derived from a cylindrical hole. The nature of the relationship between the centre axis and the cylindrical hole is indicated by a Shape_element_deriving_relationship in which the cylindrical hole is specified as the related_shape_element and the centre axis is specified as the relating_shape_-element.

Constraints:

UR1: The combination of the relating_shape_element inherited from Shape_element_relationship and related_shape_element inherited from Shape_element_relationship shall be unique within a population of Shape_element_deriving_relationship.

4.2.650 Shape_element_locating_relationship

A Shape_element_locating_relationship is a type of Managed_design_object (see 4.2.431). A Shape_-element_locating_relationship is the association between two Shape_element (see 4.2.645) in which the associated Shape_elements are located in relation to each other.

The data associated with a Shape_element_locating_relationship are the following:

— located_shape_element;

— locating_shape_element.

4.2.650.1 located_shape_element

The located_shape_element specifies the Shape_element (see 4.2.645) that is located in relation to the Shape_element specified by the locating_shape_element for the Shape_element_locating_relationship.

4.2.650.2 locating_shape_element

The locating_shape_element specifies the Shape_element (see 4.2.645) in relation to which the Shape_-element specified by the located_shape_element is located for the Shape_element_locating_relationship.

Constraints:

UR1: The combination of located and locating Shape_elements shall be unique within a population of Shape_element_locating_relationship. That is, the same Shape_elements shall not be located relative to each other more than once.

WR1: The Shape_element specified by the located_shape_element shall not be the same Shape_element specified by the locating_shape_element.

WR2: The Shape_element_locating_relationship shall be specified as either the located_elements by a Dimensional_location or as the boundary_separation by a Dimensional_size_based_on_opposing_-boundaries.

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4.2.651 Shape_element_relationship

A Shape_element_relationship is a type of Managed_design_object (see 4.2.431). A Shape_element_-relationship is one of a Parallel_shape_element_relationship (see 4.2.485), a Perpendicular_shape_element_relationship (see 4.2.515), a Shape_element_boundary_relationship (see 4.2.646), a Shape_element_constituent_relationship (see 4.2.648), or a Shape_element_deriving_relationship (see 4.2.649). Additionally, a Shape_element_relationship may be a Datum_feature_usage_in_datum_relationship (see 5.2.4.132). A Shape_element_relationship is an association between two Shape_element (see 4.2.645).

The data associated with a Shape_element_relationship are the following:

— description;

— name;

— related_shape_element;

— relating_shape_element.

4.2.651.1 description

The description specifies the descriptive label that relates the nature of the Shape_element_relationship. The description need not be specified for a Shape_element_relationship.

4.2.651.2 name

The name specifies the identifying label for the Shape_element_relationship. The name need not be specified for a Shape_element_relationship.

4.2.651.3 related_shape_element

The related_shape_element specifies the Shape_element (see 4.2.645) to which the relating_shape_element refers for the Shape_element_relationship. If one Shape_element of the relationship is dependent upon the other, this attribute shall be the dependent one.

4.2.651.4 relating_shape_element

The relating_shape_element specifies the Shape_element (see 4.2.645) that relates to another, for the Shape_element_relationship.

Constraints:

WR1: If the Shape_element_relationship is a Datum_feature_usage_in_datum_relationship it shall not also be a Parallel_shape_element_relationship, a Perpendicular_shape_element_relationship, a Shape_-element_boundary_relationship, or a Shape_element_constituent_relationship.

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4.2.652 Shape_formed_terminal

A Shape_formed_terminal is a type of a Altered_package_terminal (see 4.2.6) that defines a modification of its shape from its original Package_terminal (see 4.2.472) shape. This shape modification is done in order to facilitate the installation of a Packaged_part (see 4.2.481) in an assembly.

The data associated with a Shape_formed_terminal are the following:

— terminal_form_specification.

4.2.652.1 terminal_form_specification

The terminal_form_specification specifies the Lead_form_specification (see 5.2.4.357) of the Shape_-formed_terminal.

4.2.653 Shell_based_2d_wireframe

A Shell_based_2d_wireframe is a type of Feature_shape_definition (see 4.2.315). A Shell_based_2d_-wireframe describes the shape of a product by two-dimensional wireframe geometry with topology. This includes all two-dimensional curves and topological entities that define a graph of vertices, edges, and loops.

4.2.654 Shell_based_wireframe

A Shell_based_wireframe is a type of Bound_volume_shape (see 4.2.58). A Shell_based_wireframe maintains the topology information along with the geometric wireframe model.

4.2.655 Shield

A Shield is a type of Assembly_component (see 4.2.27) included for suppression of unwanted electro-magnetic coupling among components. An Assembly_component included in the assembly for other purposes might also serve as a Shield, and in that case the other type would be specified as well for that instance.

EXAMPLE 1 A Via (see 4.2.761) may be a Shield. More than one shield may shield the same shielded_item for the same purpose.

EXAMPLE 2 Figure 100 illustrates a detail of a layout drawing that shows a shielded trace (carrying a critical signal) on the several layers it traverses in the design.

The data associated with a Shield are the following:

— shielded_item.

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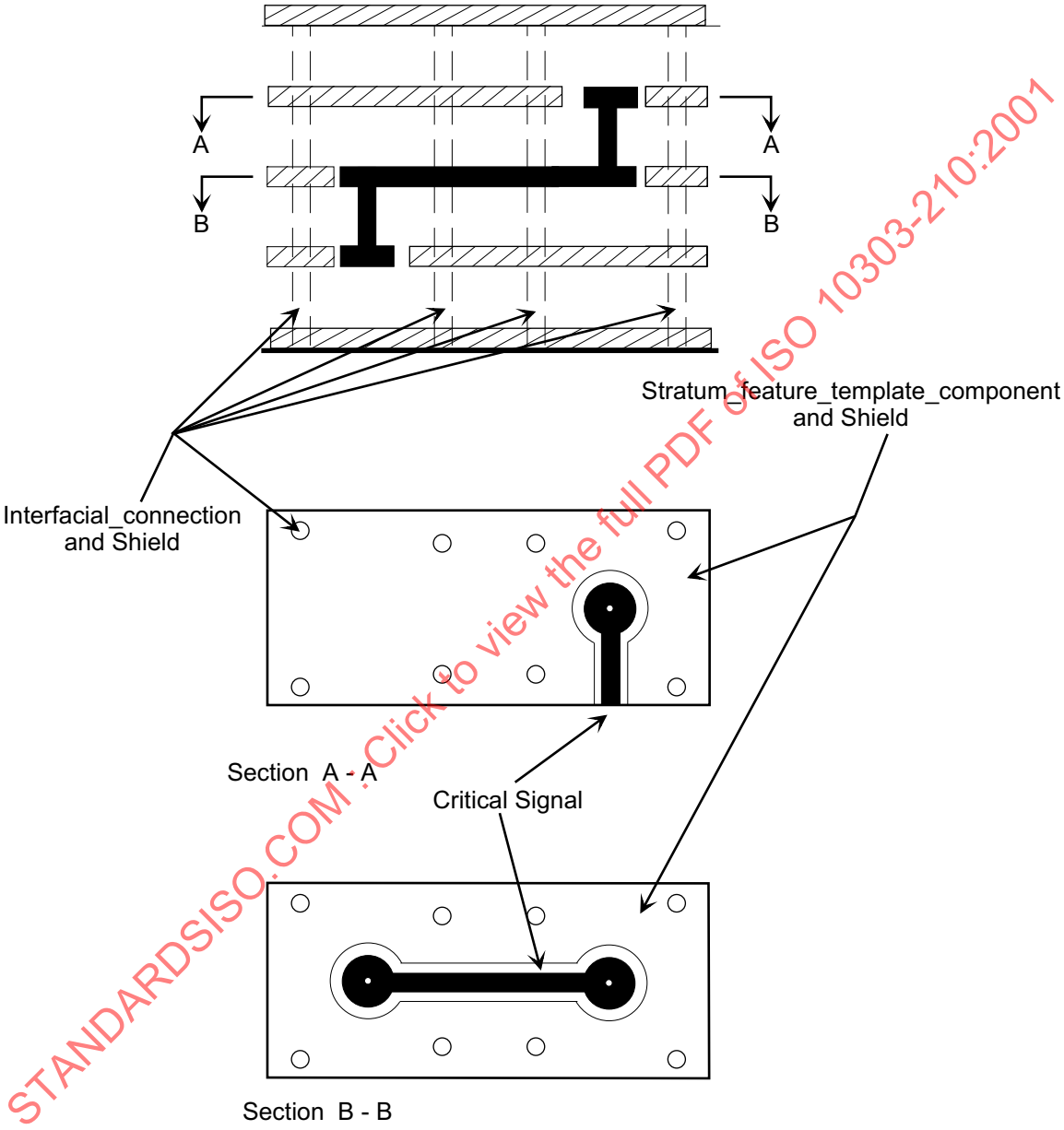

Figure 100 – Shield

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4.2.655.1 shielded_item

The shielded_item specifies either an Assembly_component (see 4.2.27), a Component_feature (see 4.2.90), or a Physical_connectivity_definition (see 5.2.4.1) as the shieldable item for a Shield. There shall be one or more Assembly_component, Component_feature, or Physical_connectivity_definition for a Shield.

4.2.656 Shield_allocation

A Shield_allocation is a type of Electromagnetic_compatibility_requirement_allocation (see 4.2.297). The Shield_allocation enables the assignment of a requirement to a shield. This allocates required properties of shielding effectiveness to the shield.

The data associated with a Shield_allocation are the following:

— assembly_assignment;

— requirement.

4.2.656.1 assembly_assignment

The assembly_assignment specifies the role of the Shield (see 4.2.655) for the Shield_allocation.

4.2.656.2 requirement

The requirement specifies the role of the Electromagnetic_requirement_occurrence (see 5.2.4.4) for the Shield_allocation.

4.2.657 Signal

A Signal is a type of Managed_design_object (see 4.2.431). A Signal in this part of ISO 10303 is an abstraction of signal as categorized according to an ISO or IEC standard. Signal in this part of ISO 10303 is specifically included for the purpose of exchanging information related to functional abstractions of products as commonly specified on data sheets. There is no predefined mechanism in this part of ISO 10303 that defines standard physical arrangement of instrumentation and test articles to support test processes. This part of ISO 10303 provides a standard mechanism to associate sets of data that characterize the behaviour of a product with the functional hierarchical model and physical geometric model of that product.

NOTE 1 A Signal is a physical phenomenon that may be characterized by means of appropriate instrumentation or simulated by a computer system for the purpose of evaluating system behaviour.

NOTE 2 IEC Multi-Lingual Dictionary Volume 2, 1992: signal (174) a physical phenomenon, one or more of whose characteristics may vary to represent information.

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EXAMPLE 1 The physical phenomenon may be, for instance, an electromagnetic wave, or acoustic wave and the characteristic may be an electric field, a voltage, or a sound pressure.

The data associated with a Signal are the following:

— signal_category.

4.2.657.1 signal_category

The signal_category specifies the External_definition (see 4.2.304) for the category for this Signal.

EXAMPLE 1 Examples of signal_category include an electromagnetic wave, or acoustic wave.

4.2.658 Signal_property

A Signal_property is a type of Managed_design_object (see 4.2.431). A Signal_property may be a Composite_signal_property (see 5.2.4.243). A Signal_property is a data set that characterizes a Signal (see 5.2.4.198) and that has units that are traceable to an ISO or IEC standard. The units may be basic Si units, derived SI units, conversion based units, or context dependent units. Conversion based and context dependent units shall be specified in the external standard that defines the signal_property_category.

The data associated with a Signal_property are the following:

— characterized_signal;

— signal_property_category;

— signal_property_representation.

4.2.658.1 characterized_signal

The characterized_signal specifies the Signal (see 5.2.4.198) that has the Signal_property.

4.2.658.2 signal_property_category

The signal_property_category specifies the role of the External_definition (see 4.2.304) for the Signal_property.

4.2.658.3 signal_property_representation

The signal_property_representation specifies the Representation (see 4.2.612) of the Signal_property.

NOTE A signal_property_representation is a function or table that maps a parameter, such as time, frequency, or distance, onto a response variable.

EXAMPLE 1 An example signal_property_representation characterizes voltage over a defined frequency range.

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4.2.659 Signal_specification

A Signal_specification is a type of Managed_design_object (see 4.2.431). A Signal_specification is a bounded behavioural characteristic as measured between two terminals of a Functional_unit (see 5.2.4.313) in a controlled environment. The characterization of the behaviour of the functional_unit_definition is in terms of the representations of the Signals that exist at the interface of the instance of the functional_unit_definition with the network within which the instance is embedded.

The data associated with a Signal_specification are the following:

— characterization_network;

— characterizing_functional_unit;

— maximum_characteristic;

— measurement_access_mechanism;

— measurement_condition;

— minimum_characteristic;

— reference_access_mechanism.

4.2.659.1 characterization_network

The characterization_network specifies the Functional_unit_network_definition (see 5.2.4.339) in which an instance of a usage view of the Functional_unit_definition (see 5.2.4.305) being characterized is embedded for this Signal_specification. In this part of ISO 10303, the characterization_network shall include all required simulated stimulus sources and measurement sensors.

EXAMPLE 1 Examples of characterization_network types include test bench (VHDL), test fixture, test circuit.

4.2.659.2 characterizing_functional_unit

The characterizing_functional_unit specifies the Functional_unit (see 5.2.4.313) being characterized by the Signal_specification.

4.2.659.3 maximum_characteristic

The maximum_characteristic specifies the upper bound for the valid range of the Signal_property (see 5.2.4.150) for the Signal_specification.

4.2.659.4 measurement_access_mechanism

The measurement_access_mechanism specifies the role of the Scalar_terminal_definition (see 4.2.639) for the Signal_specification.

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4.2.659.5 measurement_condition

The measurement_condition specifies the Test_specification (see 5.2.4.94) under which the measurements are valid, including allowed ranges for stimulus conditions, for the Signal_specification.

NOTE The measurement_condition may specify data using text or graphics.

4.2.659.6 minimum_characteristic

The minimum_characteristic specifies the lower bound for the valid range of the Signal_property (see 5.2.4.150) for the Signal_specification.

4.2.659.7 reference_access_mechanism

The reference_access_mechanism specifies the Scalar_terminal_definition (see 4.2.639) on the Functional_unit (see 5.2.4.313) being characterized by this Signal_specification. The reference_access_mechanism need not be specified for a particular Signal_specification. The purpose of the reference_access_mechanism is to provide a reference facility for measurements.

EXAMPLE 1 The reference_access_mechanism need not be supplied for evaluation of non-causal systems such as s- or z-plane characterized control system elements or digital elements. There is no assumption in this part of ISO 10303 that reference_access_mechanism is related to any standard reference node, for example, "0" in certain continuous system simulators. Example names of the terminal specified by reference_access_mechanism include Ground, Analogue ground, Digital ground, Trigger in, Gate out.

Constraints:

WR1: The External_definition in the role of signal_property_category specified by signal_property in the role of maximum_characteristic shall be the same as the External_definition in the role of signal_property_category specified by signal_property in the role of minimum_characteristic.

WR2: The measurement_access_mechanism shall access an occurrence of the definition being characterized.

WR3: The measurement_access_mechanism shall not be the reference_access_mechanism.

WR4: The network in which the functional_unit_definition being characterized is instantiated shall not be the network being characterized.

WR5: The characterizing_functional_unit shall help compose the characterization_network.

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4.2.660 Simultaneous_geometric_tolerance_requirement

A Simultaneous_geometric_tolerance_requirement is a type of Managed_design_object (see 4.2.431). A Simultaneous_geometric_tolerance_requirement is a specification that a set of two or more Geometric_tolerance (see 5.2.4.386) is to be treated as a simultaneous requirement. That is, the shape elements to which composite profile refinement tolerances and composite feature relating position tolerances are applied are treated as separate shape elements with regard to the geometric tolerances. If this type of independence is not desired, the Simultaneous_geometric_tolerance_requirement may be used to specify a set of two or more Geometric_tolerance that are to be treated as a simultaneous requirement.

NOTE Simultaneous requirements are discussed in 4.5.12.1 of ASME Y14.5M.

The data associated with a Simultaneous_geometric_tolerance_requirement are the following:

— grouped_geometric_tolerances.

4.2.660.1 grouped_geometric_tolerances

The grouped_geometric_tolerances specifies the Geometric_tolerance (see 5.2.4.386) that are to be treated as a simultaneous requirement. There shall be two or more Geometric_tolerance for a Simultaneous_geometric_tolerance_requirement.

Constraints:

WR1: The Geometric_tolerance that are specified as the grouped_geometric_tolerances either shall all be Geometric_tolerance_without_referenced_datum_system or shall all specify the same instance of Datum_system_defining_conditions as their datum_system_definition.

WR2: The Geometric_tolerance that are specified as the grouped_geometric_tolerances shall either be Composite_linear_profile_refinement_tolerance, Composite_surface_profile_refinement_tolerance, or Composite_feature_relating_position_tolerance.

4.2.661 Single_boundary_dimension

A Single_boundary_dimension is a type of Dimensional_size (see 4.2.259) that characterizes the size of a Shape_element (see 4.2.645) that can be considered to have a single boundary or have the form of a curve. A Single_boundary_dimension may be a Curve_dimension (see 5.2.4.171).

EXAMPLE 1 The diameter of a cylindrical Shape_element would be characterized with a Single_boundary_dimension.

4.2.662 Single_datum

A Single_datum is a Datum (see 4.2.176) that is established by a single Datum_feature (see 4.2.188).

NOTE The establishment of a datum by a single datum feature is described in 6.2.1 of ISO 5459.

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Constraints:

WR1: Each Single_datum shall participate in establishing at least one Datum_system.

WR2: Each Single_datum shall be specified as the relating_shape_element by exactly one Datum_-feature_usage_in_single_datum_relationship.

4.2.663 Singular_dimension_representation

A Singular_dimension_representation is a type of Shape_dimension_representation (see 4.2.644) that explicitly describes one or more Dimensional_characteristic (see 4.2.256) with a single value. A Singular_dimension_representation is one of a Maximum_dimension_representation (see 4.2.445), a Minimum_dimension_representation (see 4.2.449), or a Theoretically_exact_dimension_representation (see 4.2.722).

The data associated with a Singular_dimension_representation are the following:

— dimension_value.

4.2.663.1 dimension_value

The dimension_value specifies the Data_element (see 4.2.173) that describes the Dimensional_characteristic (see 4.2.256) for which the Singular_dimension_representation is a representation.

4.2.664 Solid_curve

A Solid_curve is a type of Managed_design_object (see 4.2.431). A Solid_curve is a Curve (see 4.2.165) that is arc-wise connected (continuous).

4.2.665 Solid_fill_style

A Solid_fill_style is a type of Managed_design_object (see 4.2.431). A Solid_fill_style is a style of fill pattern that completely fills the Fill_area (see 5.2.4.327).

4.2.666 Solid_of_linear_extrusion

A Solid_of_linear_extrusion is a type of Bound_volume_shape (see 4.2.58) defined by sweeping a planar face. The direction of translation is defined by a direction vector normal to the plane of the swept face and the length of the translation is defined by a distance "depth". The planar face may have holes which will sweep into holes in the solid.

4.2.667 Special_symbol_laminate_component

A Special_symbol_laminate_component is a type of Laminate_component (see 4.2.404) such as an enterprise logo, trademark, or other enterprise specific symbol. A Special_symbol_laminate_component may be a Primary_stratum_indicator_symbol (see 4.2.572).

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NOTE 1 A Special_symbol_laminate_component may or may not be limited to a member of a library of accepted symbols.

NOTE 2 A Special_symbol_laminate_component may or may not be scalable. A Special_symbol_laminate_component may or may not be associated with a physical net.

NOTE 3 These symbols may be stored in a library for legal reasons.

The data associated with a Special_symbol_laminate_component are the following:

— stratum_feature_implementation;

— usage_definition.

4.2.667.1 stratum_feature_implementation

The stratum_feature_implementation specifies the role of the Stratum_feature (see 4.2.683) for the Special_symbol_laminate_component.

4.2.667.2 usage_definition

The usage_definition specifies the role of the Special_symbol_part_template (see 4.2.668) for the Special_symbol_laminate_component.

4.2.668 Special_symbol_part_template

A Special_symbol_part_template is a type of Part_template (see 4.2.498) that defines a Special_symbol.

EXAMPLE 1 A corporate logo would be a Special_symbol_part_template.

4.2.669 Specification_allocation

A Specification_allocation is a type of Managed_design_object (see 4.2.431). A Specification_allocation is the association between an Ee_specification (see 4.2.292) and one or more of an Ee_product (see 4.2.274), an Ee_product_configuration (see 5.2.4.395), an Ee_product_definition (see 5.2.4.143), an Ee_product_version (see 4.2.282), a Physical_connectivity_definition (see 5.2.4.1), a Physical_connectivity_element (see 4.2.523), one or more of an Assembly_component (see 4.2.27), a Component_feature (see 4.2.90), an Ee_requirement_occurrence (see 4.2.283), a Stratum (see 4.2.677), one or more of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), or a Stratum_feature (see 4.2.683) that results from the design activity.

The data associated with a Specification_allocation are the following:

— allocated_specification;

— target_product_object.

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4.2.669.1 allocated_specification

The allocated_specification specifies the role of the Ee_specification (see 4.2.292) for the Specification_-allocation.

4.2.669.2 target_product_object

The target_product_object specifies either an Ee_product (see 4.2.274), an Ee_product_configuration (see 5.2.4.395), an Ee_product_definition (see 5.2.4.143), an Ee_product_version (see 4.2.282), a Part_-feature (see 4.2.494), a Physical_connectivity_definition (see 5.2.4.1) a Physical_connectivity_element (see 4.2.523), or one of an Assembly_component (see 4.2.27), a Component_external_reference (see 4.2.89), a Component_feature (see 4.2.90), a Component_feature_external_reference (see 4.2.91), an Ee_requirement_occurrence (see 4.2.283), a Stratum (see 4.2.677) or one of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) as the target through which the Ee_specification (see 4.2.292) is realized by the Specification_allocation. There shall be one or more Ee_product, Ee_product_configuration, Ee_product_-definition, Ee_product_version, Part_feature, Physical_connectivity_definition, Physical_connectivity_-element, Assembly_component, Component_external_reference, Component_feature, Component_feature_external_reference, Ee_requirement_occurrence, Stratum, Inter_stratum_feature, Laminate_component, Stratum_feature, or Stratum_surface for a Specification_allocation.

4.2.670 Start_order

A Start_order is a type of Work_order (see 4.2.774) that authorizes work in the ongoing development of a product design of a product, resulting in the creation of a new Ee_product_version (see 4.2.282).

4.2.671 Start_request

A Start_request is a type of Work_request (see 4.2.775) that initiates the design of a part.

4.2.672 Statistical_dimensional_tolerance

A Statistical_dimensional_tolerance is a type of Dimensional_characteristic (see 4.2.256) that specifies design requirements that are based on sound statistics. Associated with the Statistical_dimensional_tolerance is the requirement that a specified level of process control be maintained during the manufacture of the Physical_unit (see 4.2.533). A Statistical_dimensional_tolerance may specify another Dimensional_-characteristic as an alternate to the Statistical_dimensional_tolerance in the event that the specified level of process control cannot be met.

The data associated with a Statistical_dimensional_tolerance are the following:

— alternate_dimension;

— statistical_control_requirement.

NOTE Statistical tolerancing is discussed in 2.16 of ASME Y14.5M.

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4.2.672.1 alternate_dimension

The alternate_dimension specifies the Dimensional_characteristic (see 4.2.256) that shall be used if the specified level of process control cannot be met. The alternate_dimension need not be specified for a Statistical_dimensional_tolerance.

4.2.672.2 statistical_control_requirement

The statistical_control_requirement specifies the Ee_requirement_occurrence (see 4.2.283) that states the statistical process control requirements that the manufacturing facility shall meet for the Statistical_-dimensional_tolerance.

Constraints:

WR1: If a Dimensional_characteristic is specified as an alternate_dimension, the specified Dimensional_characteristic shall not be a Statistical_dimensional_tolerance.

WR2: If a Dimensional_characteristic is specified as an alternate_dimension, the Dimensional_characteristic shall characterize the same Shape_element or Shape_element_locating_relationship as characterized by the Statistical_dimensional_tolerance.

4.2.673 Statistical_geometric_tolerance

A Statistical_geometric_tolerance is a type of Geometric_tolerance (see 5.2.4.386) that specifies design requirements that are based on sound statistics. Associated with the Statistical_geometric_tolerance is the requirement that a specified level of process control be maintained during the manufacture of the Physical_unit (see 4.2.533). A Statistical_geometric_tolerance may specify another Geometric_-tolerance as an alternate to the Statistical_geometric_tolerance in the event that the specified level of process control cannot be met.

The data associated with a Statistical_geometric_tolerance are the following:

— alternate_tolerance;

— statistical_control_requirement.

NOTE Statistical tolerancing is discussed in 2.16 of ASME Y14.5M.

4.2.673.1 alternate_tolerance

The alternate_tolerance specifies the Geometric_tolerance (see 5.2.4.386) that shall be used if the specified level of process control cannot be met. The alternate_tolerance need not be specified for a Statistical_geometric_tolerance.

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4.2.673.2 statistical_control_requirement

The statistical_control_requirement specifies the Ee_requirement_occurrence (see 4.2.283) that states the statistical process control requirements that the manufacturing facility shall meet for the Statistical_-geometric_tolerance.

Constraints:

WR1: If a Geometric_tolerance is specified as an alternate_tolerance, the specified Geometric_tolerance shall not be a Statistical_geometric_tolerance.

WR2: If a Geometric_tolerance is specified as an alternate_tolerance, the Shape_element specified as the toleranced_shape_element by the Statistical_geometric_tolerance shall be the same instance of Shape_element as specified as the toleranced_shape_element by the Geometric_tolerance specified as the alternate_tolerance.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

4.2.674 Statistical_tolerance_characteristic

A Statistical_tolerance_characteristic is a type of Tolerance_characteristic (see 5.2.4.168). The Statistical_tolerance_characteristic supports the exchange of properties defined by statistical distributions.

Constraints:

IP1: The component_characteristic inherited from Coordinated_characteristic shall all participate in the characterization of one statistical tolerance.

IP2: The type_name inherited from Coordinated_characteristic shall be a recognized statistical tolerance type.

4.2.675 Step_edge_feature_shape

A Step_edge_feature_shape is a type of Edge_shape (see 4.2.268) that is the two-dimensional definition of the construction of a step edge. See Bevel_edge_feature_shape (see 4.2.51) for additional supporting geometric information that shall be provided.

EXAMPLE 1 Figure 101 illustrates a detail of a fabrication drawing that shows some of the information exchanged for construction of a step edge.

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The data associated with a Step_edge_feature_shape are the following:

— maximum_step_depth;

— maximum_step_width;

— minimum_step_depth;

— minimum_step_width.

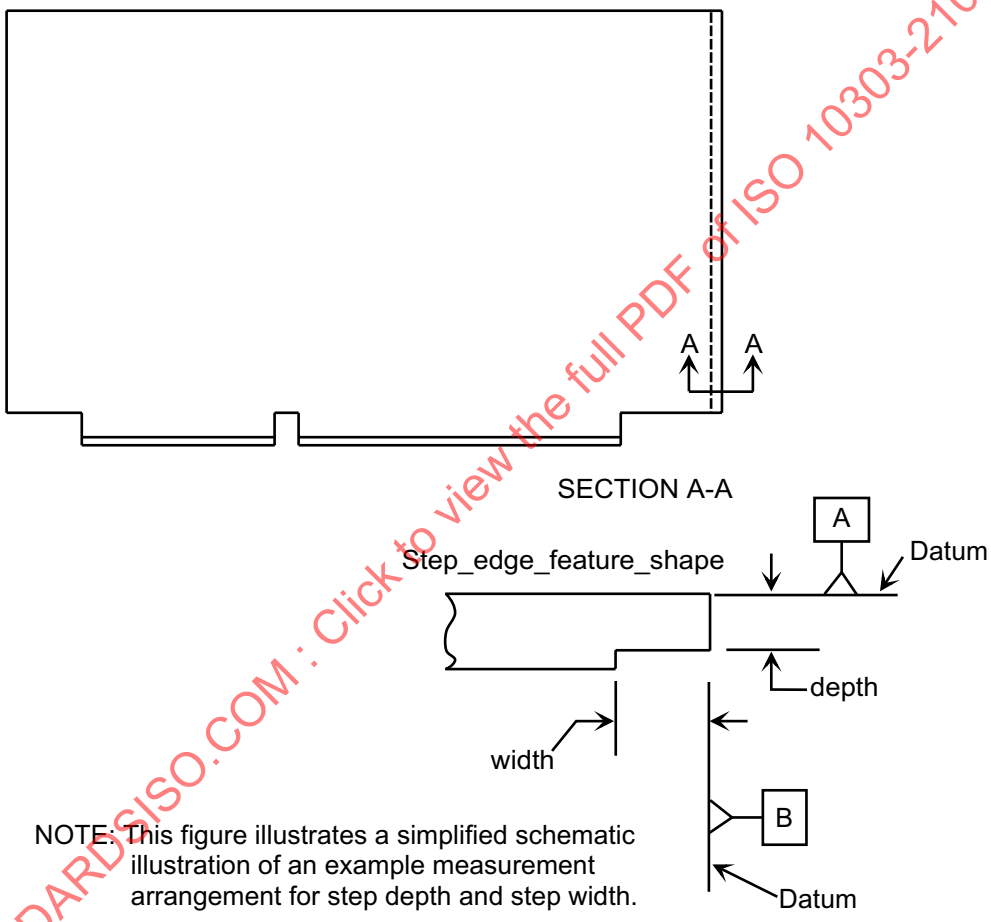

Figure 101 – Step_edge_feature_shape

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4.2.675.1 maximum_step_depth

The maximum_step_depth specifies the Length_data_element (see 4.2.422) of the maximum depth of the step relative to the datum surface.

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4.2.675.2 maximum_step_width

The maximum_step_width specifies the Length_data_element (see 4.2.422) of the maximum width of the step relative to the edge surface that is stepped.

4.2.675.3 minimum_step_depth

The minimum_step_depth specifies the Length_data_element (see 4.2.422) of the minimum depth of the step relative to the datum surface.

4.2.675.4 minimum_step_width

The minimum_step_width specifies the Length_data_element (see 4.2.422) of the minimum width of the step relative to the edge surface that is stepped.

4.2.676 Straightness_tolerance

A Straightness_tolerance is a type of Geometric_tolerance_without_referenced_datum_system (see 4.2.358) that specifies or partially specifies the design requirement on the straightness of either the Shape_element (see 4.2.645) to which the Straightness_tolerance is applied or of constituent elements of the Shape_element to which the Straightness_tolerance is applied. When the design requirements are on the straightness of constituent elements of a non-axial Shape_element, the orientation of the Tolerance_zone_boundary (see 4.2.734) is specified by a Viewing_plane (see 4.2.769) to which the Tolerance_zone_boundary is parallel.

NOTE Straightness tolerance is defined in terms of tolerance zone definitions in 14.1 of ISO 1101.

Constraints:

WR1: The Shape_element specified by the toleranced_shape_element shall be either a Physical_feature_or_part_template, a Centre_axis or a Centre_plane

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: If the toleranced_shape_element is a Centre_axis, the Straightness_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify a Diametrical_boundary_size_characteristic as its specified_boundary_size; otherwise, the Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as the specified_boundary_size.

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WR3: If the toleranced_shape_element is a Physical_feature_or_part_template, the Tolerance_zone_definition that is specified as the tolerance_zone_or_boundary_definition shall be a Tolerance_zone_definition_with_specified_orientation that specifies a Viewing_plane_based_orientation as its zone_orientation; otherwise, the Tolerance_zone_definition shall not be a Tolerance_zone_definition_with_specified_orientation.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a straightness tolerance is sensible.

4.2.677 Stratum

A Stratum is a type of Managed_design_object (see 4.2.431). A Stratum may be a Documentation_layer_stratum (see 5.2.4.62) or a Design_layer_stratum (see 5.2.4.382). A Stratum consists of a single material within an interconnect substrate. The vertical contours of either boundary surface may vary. Thus, the thickness of the stratum may vary throughout its range. The material used may be specific, such as 24K gold, or more general, such as etched copper. There may only be one boundary.

EXAMPLE 1 Figure 102 illustrates a detail of a stackup drawing included on a fabrication drawing in some cases. In most cases, the detail in this figure is generated at the fabricator's facility from more generic engineering data. This part of ISO 10303 is capable of supporting exchange of generic material stackup data or very explicit material stackup data. This part of ISO 10303 considers either stackup data set as design data. An enterprise may track the source of the stackup data through the design_supplier attribute of Ee_product_version (see 4.2.282).

The data associated with a Stratum are the following:

— assembly;

— bound_volume_shape;

— name;

— of_average_surface;

— of_surface;

— of_technology;

— planar_shape;

— stratum_usage.

4.2.677.1 assembly

The assembly is an inverse relationship that specifies the Interconnect_module_stratum_assembly_relationship (see 5.2.4.160) that specifies the Stratum as its component. There shall be one or more Interconnect_module_stratum_assembly_relationship for a Stratum, but they shall all be for the same product.

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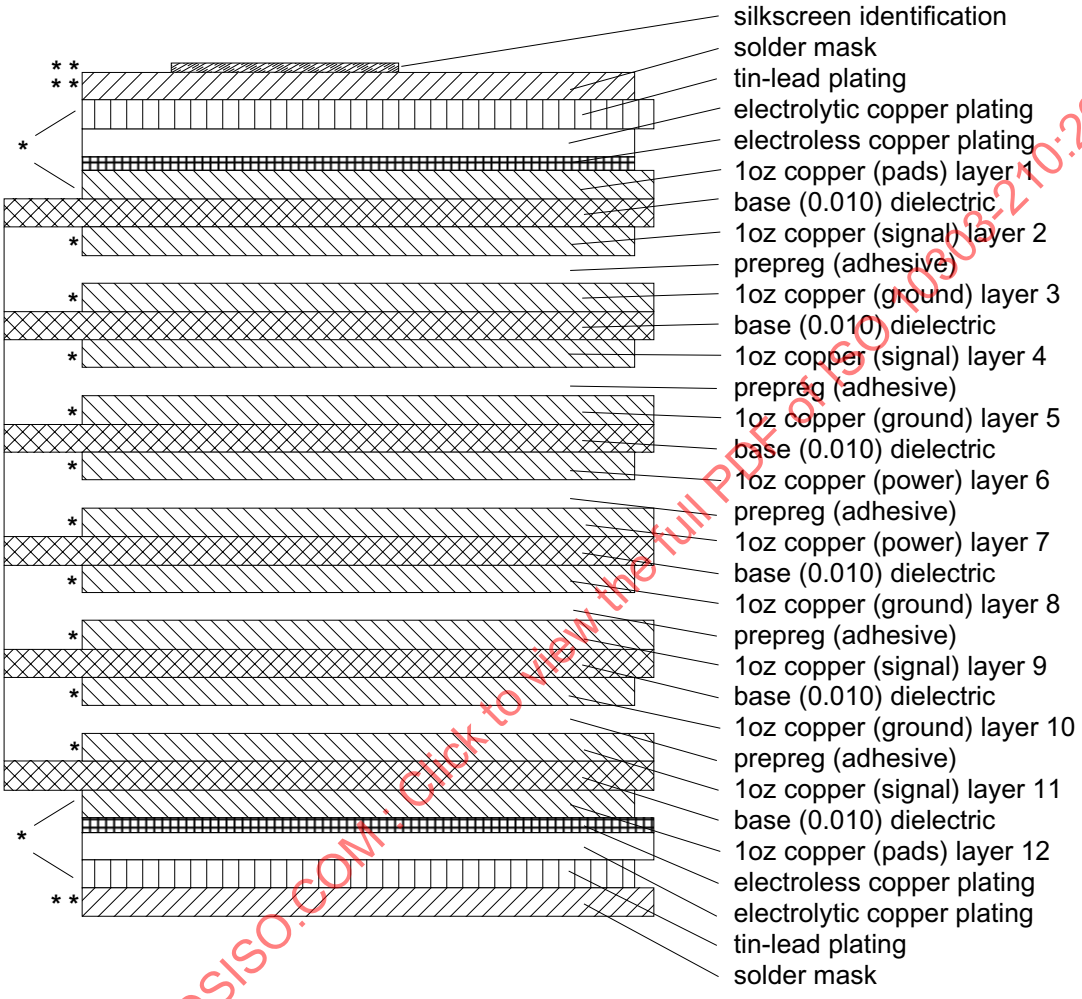

* Design_layer_stratum * * Documentation_layer_stratum

This illustration shows different types of Stratum in a typical multi-layer printed circuit board cross section view. Stratum without footnote references are neither Design_layer_stratum or Documentation_layer_stratum.

Figure 102 – Stratum

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4.2.677.2 bound_volume_shape

The bound_volume_shape is an inverse relationship that specifies the Stratum_3d_shape (see 5.2.4.410) that specifies the Stratum as its shape_characterized_stratum. There shall be no more than one Stratum_3d_shape for a Stratum.

4.2.677.3 name

The name specifies an identifier of a Stratum.

4.2.677.4 of_average_surface

An of_average_surface is an inverse attribute which specifies the Stratum_average_surface (see 4.2.679) of the Stratum as its of_stratum. There shall be no more than one Stratum_average_surface for a Stratum.

4.2.677.5 of_surface

An of_surface is an inverse attribute which specifies one or two Stratum_surface (see 4.2.699) for a Stratum.

4.2.677.6 of_technology

The of_technology specifies the role of the Stratum_technology (see 4.2.702) for the Stratum.

4.2.677.7 planar_shape

The planar_shape is an inverse relationship that specifies the Stratum_planar_shape (see 5.2.4.206) that specifies the Stratum as its shape_characterized_stratum. There shall be no more than one Stratum_planar_shape for a Stratum.

4.2.677.8 stratum_usage

The stratum_usage specifies the External_definition (see 4.2.304) that describes the purpose for incorporating a stratum in the Interconnect_module (see 4.2.372) design. The stratum_usage need not be specified for a particular Stratum.

Constraints:

UR1: The combination of the assembly and the name shall be unique within a population of Stratum.

4.2.678 Stratum_3d_shape

A Stratum_3d_shape is a type of Managed_design_object (see 4.2.431). A Stratum_3d_shape is the three-dimensional shape of a Stratum (see 4.2.677).

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The data associated with a Stratum_3d_shape are the following:

— shape_characterized_stratum.

4.2.678.1 shape_characterized_stratum

The shape_characterized_stratum specifies the role of the Stratum (see 4.2.677) for the Stratum_3d_-shape.

4.2.679 Stratum_average_surface

A Stratum_average_surface is a type of Managed_design_object (see 4.2.431). A Stratum_average_-surface specifies the constructed geometry that is the average of the primary and secondary surface for a Stratum (see 4.2.677). A Stratum_average_surface is provided as a construction aid in defining a Stratum.

The data associated with a Stratum_average_surface are the following:

— of_shape;

— of_stratum.

4.2.679.1 of_shape

An of_shape is an inverse relationship that specifies the role of a Stratum_average_surface_shape (see 5.2.4.380) for a Stratum_average_surface. An of_shape need not be specified for a Stratum_average_-surface.

4.2.679.2 of_stratum

An of_stratum specifies the role of a Stratum (see 4.2.677) for a Stratum_average_surface.

4.2.680 Stratum_average_surface_shape

A Stratum_average_surface_shape is a type of Managed_design_object (see 4.2.431). A Stratum_av-erage_surface_shape is the representation of a Stratum_average_surface (see 4.2.679) using an open manifold surface.

The data associated with a Stratum_average_surface_shape are the following:

— of_surface.

4.2.680.1 of_surface

The of_surface specifies the role of a Stratum_average_surface (see 4.2.679) for the Stratum_average_-surface_shape.

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4.2.681 Stratum_concept_relationship

A Stratum_concept_relationship is a type of Managed_design_object (see 4.2.431). A Stratum_concept_relationship is a Dielectric_crossover_area (see 5.2.4.340) or a Stratum_feature_conductive_join (see 4.2.685).

The data associated with a Stratum_concept_relationship are the following:

— resulting_shape;

— technology_requirement.

4.2.681.1 resulting_shape

The resulting_shape specifies the role of the Feature_shape_definition (see 4.2.315) for the Stratum_concept_relationship. The resulting_shape need not be specified for a particular Stratum_concept_relationship.

4.2.681.2 technology_requirement

The technology_requirement specifies the Ee_requirement_occurrence (see 4.2.283) that results in the resulting_shape. There shall be one or more Ee_requirement_occurrence for a Stratum_concept_relationship.

4.2.682 Stratum_concept_to_physical_usage_view_assignment

A Stratum_concept_to_physical_usage_view_assignment is a type of Managed_design_object (see 4.2.431). A Stratum_concept_to_physical_usage_view_assignment is the relationship between a Part_feature (see 4.2.494) and any one of an Inter_stratum_feature (see 4.2.364), a Laminate_component (see 4.2.404), a Stratum (see 4.2.677), Stratum_feature (see 4.2.683), or a Stratum_surface (see 4.2.699) for the purpose of traceability between the Part_feature and the underlying design feature.

The data associated with a Stratum_concept_to_physical_usage_view_assignment are the following:

— assigned_design_object;

— defined_part_feature.

4.2.682.1 assigned_design_object

The assigned_design_object specifies any one of the Inter_stratum_feature (see 4.2.364), Laminate_component (see 4.2.404), Stratum (see 4.2.677), Stratum_feature (see 4.2.683), or Stratum_surface (see 4.2.699) as the assigned object for the Stratum_concept_to_physical_usage_view_assignment.

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4.2.682.2 defined_part_feature

The defined_part_feature specifies the role of the Part_feature (see 4.2.494) for the Stratum_concept_-to_physical_usage_view_assignment.

4.2.683 Stratum_feature

A Stratum_feature is a type of Physical_feature_or_part_template (see 4.2.527). A Stratum_feature may be either a Conductive_filled_area (see 5.2.4.365) or a Conductor (see 5.2.4.162), or additionally may be a Fiducial_stratum_feature (see 5.2.4.326). A Stratum_feature is a shape realized in the material of the Stratum (see 4.2.677).

EXAMPLE 1 Figure 103 illustrates several types of Stratum_feature. The Conductors shown are purposely distorted in aspect ratio because Conductors are enclosed shapes.

The data associated with a Stratum_feature are the following:

— feature_of_size;

— name;

— resident_stratum.

4.2.683.1 feature_of_size

The feature_of_size specifies whether or not the Stratum_feature interfaces with a feature of another product in an assembly context. A value of TRUE indicates that the Stratum_feature interfaces with a feature of another product. A value of FALSE indicates that the Stratum_feature does not interface with a feature of another product.

NOTE Certain tolerance information depends on knowledge of a particular feature interfacing with features of a mating product.

4.2.683.2 name

The name specifies the identifier of the Stratum_feature.

4.2.683.3 resident_stratum

The resident_stratum specifies the Stratum (see 4.2.677) being composed by the Stratum_feature.

Constraints:

UR1: The combination of the name and the resident_stratum shall be unique within a population of Stratum_features.

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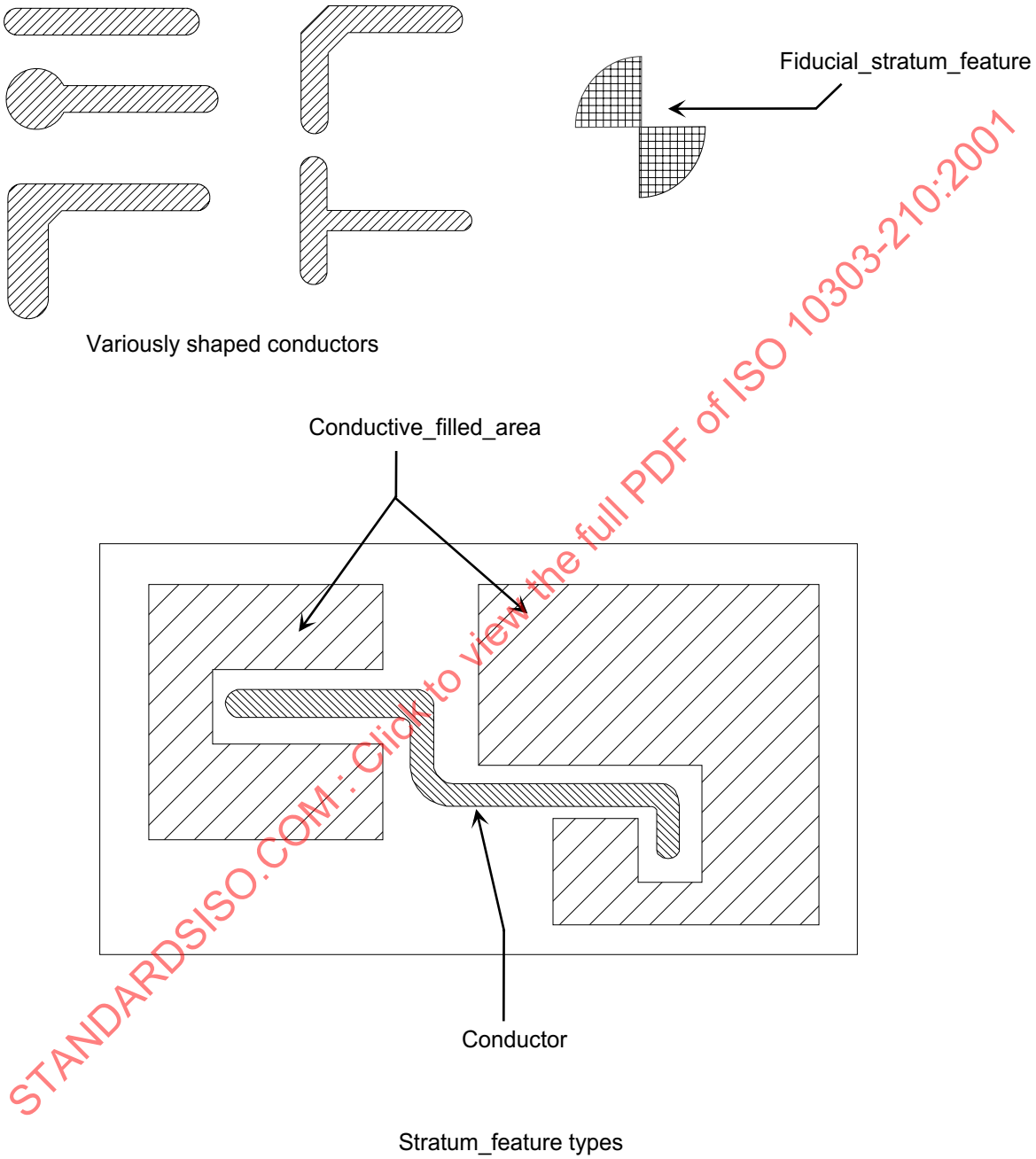

Figure 103 – Stratum_feature

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4.2.684 Stratum_feature_3d_shape

A Stratum_feature_3d_shape is a type of Managed_design_object (see 4.2.431). A Stratum_feature_-3d_shape is the representation of a Stratum_feature (see 4.2.683) using a closed volume.

The data associated with a Stratum_feature_3d_shape are the following:

— represented_stratum_feature;

— shape_representation.

4.2.684.1 represented_stratum_feature

The represented_stratum_feature specifies the role of a Stratum_feature (see 4.2.683) for the Stratum_-feature_3d_shape.

4.2.684.2 shape_representation

The shape_representation specifies the role of a Bound_volume_shape (see 4.2.58) for the Stratum_-feature_3d_shape.

4.2.685 Stratum_feature_conductive_join

A Stratum_feature_conductive_join is a type of Stratum_concept_relationship (see 5.2.4.359). A Stratum_feature_conductive_join may be a Physical_network_supporting_stratum_feature_conductive_join (see 5.2.4.32). A Stratum_feature_conductive_join is a connection between two conductive Stratum_-feature (see 4.2.683) on disjoint Stratum (see 4.2.677) that is not a passage.

NOTE The two facing surfaces of conductive features are joined.

The data associated with a Stratum_feature_conductive_join are the following:

— related_concept;

— relating_concept;

— using_via.

4.2.685.1 related_concept

The related_concept specifies the source Stratum_feature_template_component (see 5.2.4.161) for the Stratum_feature_conductive_join.

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4.2.685.2 relating_concept

The relating_concept specifies the target Stratum_feature_template_component (see 5.2.4.161) for the Stratum_feature_conductive_join.

4.2.685.3 using_via

The using_via is an inverse relationship that specifies that there shall be no more than one Bonded_conductive_base_blind_via (see 4.2.56) that specifies the Stratum_feature_conductive_join as its features_join. The using_via need not be specified for a particular Stratum_feature_conductive_join.

Constraints:

WR1: Each member of Stratum_feature_template_component in the role of relating_concept for this Stratum_feature_conductive_join shall not be in the role of related_concept for this member of Stratum_feature_conductive_join.

WR2: A Stratum_feature_template_component shall not be an ancestor or descendant of itself in this relationship.

4.2.686 Stratum_feature_in_stratum_3d_position

A Stratum_feature_in_stratum_3d_position is a type of Managed_design_object (see 4.2.431). A Stratum_feature_in_stratum_3d_position is the three-dimensional position and orientation of a three-dimensional model of a Stratum_feature (see 4.2.683) in the three-dimensional model of the Stratum (see 4.2.677).

The data associated with a Stratum_feature_in_stratum_3d_position are the following:

— feature_shape;

— stratum_shape;

— transformation.

4.2.686.1 feature_shape

The feature_shape specifies the role of either the Stratum_feature_3d_shape (see 4.2.684), or the Stratum_feature_non_planar_2d_shape (see 4.2.688) for the Stratum_feature_in_stratum_3d_position.

4.2.686.2 stratum_shape

The stratum_shape specifies the role of the Stratum_3d_shape (see 5.2.4.410) for the Stratum_feature_in_stratum_3d_position.

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4.2.686.3 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Stratum_feature_-in_stratum_3d_position.

4.2.687 Stratum_feature_in_stratum_planar_position

A Stratum_feature_in_stratum_planar_position is a type of Managed_design_object (see 4.2.431). A Stratum_feature_in_stratum_planar_position is the two-dimensional position and orientation of a two-dimensional model of a Stratum_feature (see 4.2.683) in the two-dimensional model of the Stratum (see 4.2.677).

The data associated with a Stratum_feature_in_stratum_planar_position are the following:

— feature_shape;

— stratum_shape;

— transformation.

4.2.687.1 feature_shape

The feature_shape specifies either a Stratum_feature_planar_shape (see 4.2.689) or a Stratum_feature_-styled_area_representation (see 5.2.4.373) for the Stratum_feature_in_stratum_planar_position.

4.2.687.2 stratum_shape

The stratum_shape specifies the role of the Stratum_planar_shape (see 5.2.4.206) for the Stratum_feature_in_stratum_planar_position.

4.2.687.3 transformation

The transformation specifies the role of the Axis_placement_2d (see 4.2.44) for the Stratum_feature_-in_stratum_planar_position.

4.2.688 Stratum_feature_non_planar_2d_shape

A Stratum_feature_non_planar_2d_shape is a type of Managed_design_object (see 4.2.431). A Stratum_feature_non_planar_2d_shape is the representation of a Stratum_feature (see 4.2.683) using an open manifold surface.

The data associated with a Stratum_feature_non_planar_2d_shape are the following:

— represented_stratum_feature;

— shape_representation.

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4.2.688.1 represented_stratum_feature

The represented_stratum_feature specifies the role of a Stratum_feature (see 4.2.683) for the Stratum_-feature_non_planar_2d_shape.

4.2.688.2 shape_representation

The shape_representation specifies the role of a Open_shell_based_surface (see 5.2.4.39) for the Stratum_feature_non_planar_2d_shape.

4.2.689 Stratum_feature_planar_shape

A Stratum_feature_planar_shape is a type of Managed_design_object (see 4.2.431). A Stratum_feature_-planar_shape is the representation of a Stratum_feature (see 4.2.683) by a Planar_projected_shape (see 5.2.4.45).

The data associated with a Stratum_feature_planar_shape are the following:

— represented_stratum_feature;

— shape_representation.

4.2.689.1 represented_stratum_feature

The represented_stratum_feature specifies the Stratum_feature (see 4.2.683) that is to be characterized by the Stratum_feature_planar_shape.

4.2.689.2 shape_representation

The shape_representation specifies the Planar_projected_shape (see 5.2.4.45) for the representation of the Stratum_feature (see 4.2.683).

4.2.690 Stratum_feature_shape_stratum_average_surface_shape_relationship

A Stratum_feature_shape_stratum_average_surface_shape_relationship is a type of Managed_design_-object (see 4.2.431). A Stratum_feature_shape_stratum_average_surface_shape_relationship is the association between a Stratum_feature_non_planar_2d_shape (see 4.2.688) and a Stratum_average_surface_shape (see 5.2.4.380) for the purpose of specifying that the points on the Stratum_feature_non_planar_2d_shape shall be in the domain of the points on the Stratum_average_surface_shape.

The data associated with a Stratum_feature_shape_stratum_average_surface_shape_relationship are the following:

— of_stratum_feature_shape;

— of_stratum_average_surface_shape.

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4.2.690.1 of_stratum_feature_shape

The of_stratum_feature_shape specifies the dependent Stratum_feature_non_planar_2d_shape (see 4.2.688) for the Stratum_feature_shape_stratum_average_surface_shape_relationship.

4.2.690.2 of_stratum_average_surface_shape

The of_stratum_average_surface_shape specifies the independent Stratum_average_surface_shape (see 5.2.4.380) for the Stratum_feature_shape_stratum_average_surface_shape_relationship.

4.2.691 Stratum_feature_shape_stratum_surface_shape_relationship

A Stratum_feature_shape_stratum_surface_shape_relationship is a type of Managed_design_object (see 4.2.431). A Stratum_feature_shape_stratum_surface_shape_relationship is the association between a Stratum_feature_non_planar_2d_shape (see 4.2.688) and a Stratum_surface_shape (see 5.2.4.115) for the purpose of specifying that the points on the Stratum_feature_non_planar_2d_shape shall be in the domain of the points on the Stratum_surface_shape.

The data associated with a Stratum_feature_shape_stratum_surface_shape_relationship are the following:

— of_stratum_feature_shape;

— of_stratum_surface_shape.

4.2.691.1 of_stratum_feature_shape

The of_stratum_feature_shape specifies the dependent Stratum_feature_non_planar_2d_shape (see 4.2.688) for the Stratum_feature_shape_stratum_surface_shape_relationship.

4.2.691.2 of_stratum_surface_shape

The of_stratum_surface_shape specifies the independent Stratum_surface_shape (see 5.2.4.115) for the Stratum_feature_shape_stratum_surface_shape_relationship.

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4.2.692 Stratum_feature_styled_area_representation

A Stratum_feature_styled_area_representation is a type of Managed_design_object (see 4.2.431). A Stratum_feature_styled_area_representation is the association between one or more of a Stratum_feature (see 4.2.683) and one of a Fill_area_occurrence (see 5.2.4.69), or a Styled_curve_occurrence (see 5.2.4.81). The Stratum_feature_styled_area_representation is intended for use where legacy data may need to be exchanged via this Standard or where complex patterns of Stratum_feature are to be created. The Stratum_feature_styled_area_representation specifies parametric data to be input to an algorithm. The algorithm output shall be the individual Stratum_feature shapes. Once the individual Stratum_feature shapes are available, they may be used if explicit shape data is required by a receiving processor. If the individual shapes are provided, the attribute derived_planar_shape shall be populated to identify the derived shapes. The units used in the Stratum_feature_styled_area_representation shall be those specified in the global geometric context for the Interconnect_module (see 4.2.372) design as specified by Cartesian_coordinate_system (see 4.2.66).

NOTE A Stratum_feature_styled_area_representation is not intended to be used to represent a complex Stratum_feature resulting from multiple design intent modifications to a basic shape. The other types of Stratum_feature shape representation should be used to convey that information.

EXAMPLE 1 The Stratum_feature_styled_area_representation for a "dot" pattern used in manufacturing will result in multiple Stratum_feature for one instance of Stratum_feature_styled_area_representation. Legacy vector formats that "paint" filled areas using a successive approximation application of a constant width curve may be supported with Stratum_feature_styled_area_representation using the Styled_curve_occurrence option. If the curve width varies, use of multiple Design_intent_modification_styled_area_representation (see 5.2.4.24) may be appropriate.

The data associated with a Stratum_feature_styled_area_representation are the following:

— derived_planar_shape;

— represented_stratum_feature;

— shape_styled_area_representation.

4.2.692.1 derived_planar_shape

The derived_planar_shape specifies the role of the Stratum_feature_planar_shape (see 4.2.689) for the Stratum_feature_styled_area_representation. There may be more than one Stratum_feature_planar_shape for the Stratum_feature_styled_area_representation if the Stratum_feature_styled_area_representation is discontiguous. The Stratum_feature_planar_shape need not be supplied for the Stratum_feature_styled_area_representation.

4.2.692.2 represented_stratum_feature

The represented_stratum_feature specifies the role of the Stratum_feature (see 4.2.683) for the Stratum_feature_styled_area_representation. There may be more than one Stratum_feature for the Stratum_feature_styled_area_representation if the Stratum_feature_styled_area_representation is discontiguous.

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NOTE More than one Stratum_feature is required if the shape of the Stratum_feature_styled_area_representation is not a contiguous shape, since Stratum_feature is required to be a single contiguous shape.

4.2.692.3 shape_styled_area_representation

The shape_styled_area_representation specifies one of a Fill_area_occurrence (see 5.2.4.69), or a Styled_curve_occurrence (see 5.2.4.81) as the representation for the Stratum_feature_styled_area_representation.

4.2.693 Stratum_feature_template

A Stratum_feature_template is a type of Part_template (see 4.2.498) that is a definition or partial definition of a Stratum_feature (see 4.2.683). A Stratum_feature_template may be a Land_physical_template (see 5.2.4.85). A Stratum_feature_template defines a contiguous material shape.

4.2.694 Stratum_feature_template_component

A Stratum_feature_template_component is a type of Laminate_component (see 4.2.404). A Stratum_feature_template_component may be a Land (see 4.2.407) or a Non_functional_land (see 5.2.4.274).

The data associated with a Stratum_feature_template_component are the following:

— stratum_feature_implementation;

— usage_definition.

4.2.694.1 stratum_feature_implementation

The stratum_feature_implementation specifies the Stratum_feature (see 4.2.683) that the Stratum_feature_template_component is helping to compose.

4.2.694.2 usage_definition

The usage_definition specifies the role of the Stratum_feature_template (see 5.2.4.317) for the Stratum_feature_template_component.

4.2.695 Stratum_interconnect_module_3d_position

A Stratum_interconnect_module_3d_position is a type of Managed_design_object (see 4.2.431). A Stratum_interconnect_module_3d_position is the position of the Stratum (see 4.2.677) model in the Interconnect_module (see 4.2.372) model in three dimensions.

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The data associated with a Stratum_interconnect_module_3d_position are the following:

— interconnect_module_shape;

— stratum_component;

— stratum_shape;

— transformation.

4.2.695.1 interconnect_module_shape

The interconnect_module_shape specifies the Physical_unit_3d_shape (see 4.2.534) that is the Interconnect_module (see 4.2.372) model for the Stratum_interconnect_module_3d_position.

4.2.695.2 stratum_component

The stratum_component specifies the role of the Interconnect_module_stratum_assembly_relationship (see 5.2.4.160) for the Stratum_interconnect_module_3d_position.

4.2.695.3 stratum_shape

The stratum_shape specifies the Stratum_3d_shape (see 5.2.4.410) for the Stratum (see 4.2.677) model for the Stratum_interconnect_module_3d_position.

4.2.695.4 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Stratum_interconnect_module_3d_position.

4.2.696 Stratum_interconnect_module_planar_position

A Stratum_interconnect_module_planar_position is a type of Managed_design_object (see 4.2.431). A Stratum_interconnect_module_planar_position is the position of the Stratum (see 4.2.677) model in the Interconnect_module (see 4.2.372) model in two dimensions.

The data associated with a Stratum_interconnect_module_planar_position are the following:

— interconnect_module_shape;

— stratum_component;

— stratum_shape;

— transformation.

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4.2.696.1 interconnect_module_shape

The interconnect_module_shape specifies the Physical_unit_planar_shape (see 4.2.536) for the Interconnect_module (see 4.2.372) model for the Stratum_interconnect_module_planar_position.

4.2.696.2 stratum_component

The stratum_component specifies the role of the Interconnect_module_stratum_assembly_relationship (see 5.2.4.160) for the Stratum_interconnect_module_planar_position.

4.2.696.3 stratum_shape

The stratum_shape specifies the Stratum_planar_shape (see 5.2.4.206) for the Stratum (see 4.2.677) model for the Stratum_interconnect_module_planar_position.

4.2.696.4 transformation

The transformation specifies the role of the Axis_placement_2d (see 4.2.44) for the Stratum_interconnect_module_planar_position.

4.2.697 Stratum_make_from_relationship

A Stratum_make_from_relationship is a type of Managed_design_object (see 4.2.431). A Stratum_make_from_relationship is an association between a Stratum (see 4.2.677) whose design is intended to be reused and a Stratum that results from the reuse. The resultant_stratum may differ from the reusable_stratum for the particular Interconnect_module (see 4.2.372) design.

The data associated with a Stratum_make_from_relationship are the following:

— resultant_stratum;

— reusable_stratum.

4.2.697.1 resultant_stratum

The resultant_stratum specifies the Stratum (see 4.2.677) for the result of a design activity that started with reusable_stratum.

4.2.697.2 reusable_stratum

The reusable_stratum specifies the Stratum (see 4.2.677) that is intended to be used as a reference from which to create a resultant_stratum.

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4.2.698 Stratum_planar_shape

A Stratum_planar_shape is a type of Managed_design_object (see 4.2.431). A Stratum_planar_shape is the two-dimensional shape model of a Stratum (see 4.2.677).

The data associated with a Stratum_planar_shape are the following:

— shape_characterized_stratum.

4.2.698.1 shape_characterized_stratum

The shape_characterized_stratum specifies the role of the Stratum (see 4.2.677) for the Stratum_planar_-shape.

4.2.699 Stratum_surface

A Stratum_surface is a type of Managed_design_object (see 4.2.431). A Stratum_surface specifies the primary_surface or secondary_surface for a Stratum (see 4.2.677).

The data associated with a Stratum_surface are the following:

— name;

— of_stratum.

4.2.699.1 name

The name designates a primary_surface or a secondary_surface for a Stratum_surface.

4.2.699.2 of_stratum

An of_stratum specifies the Stratum (see 4.2.677) for a Stratum_surface.

Constraints:

UR1: The combination of name and of_stratum shall be unique within a population of Stratum_surface.

4.2.700 Stratum_surface_in_stratum_3d_position

A Stratum_surface_in_stratum_3d_position is a type of Managed_design_object (see 4.2.431). A Stratum_surface_in_stratum_3d_position is the three-dimensional position and orientation of a two-dimensional constructed surface model in the three-dimensional model of the Stratum (see 4.2.677).

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NOTE The surface represented by the construct may be constructed in a CAD system as a design abstraction or may be a realizeable surface.

The data associated with a Stratum_surface_in_stratum_3d_position are the following:

— stratum_shape;

— surface_shape;

— transformation.

4.2.700.1 stratum_shape

The stratum_shape specifies the role of the Stratum_3d_shape (see 5.2.4.410) for the Stratum_surface_-in_stratum_3d_position.

4.2.700.2 surface_shape

The surface_shape specifies the role of either the Stratum_average_surface_shape (see 5.2.4.380) or of the Stratum_surface_shape (see 5.2.4.115) for the Stratum_surface_in_stratum_3d_position.

4.2.700.3 transformation

The transformation specifies the role of the Axis_placement_3d (see 4.2.45) for the Stratum_surface_-in_stratum_3d_position.

4.2.701 Stratum_surface_shape

A Stratum_surface_shape is a type of Managed_design_object (see 4.2.431). A Stratum_surface_shape is the representation of a Stratum_surface (see 4.2.699) using an open manifold surface.

The data associated with a Stratum_surface_shape are the following:

— of_surface.

4.2.701.1 of_surface

The of_surface specifies the role of a Stratum_surface (see 4.2.699) for the Stratum_surface_shape.

4.2.702 Stratum_technology

A Stratum_technology is a type of Managed_design_object (see 4.2.431). A Stratum_technology may be either a Design_layer_technology (see 5.2.4.87) or a Documentation_layer_technology (see 5.2.4.212). A Stratum_technology provides material properties, parametric data associated with the technology, and material identification.

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The data associated with a Stratum_technology are the following:

— laminate_stiffness_class;

— maximum_feature_size_requirement;

— maximum_stratum_thickness;

— minimum_finished_feature_size;

— minimum_finished_feature_spacing;

— minimum_stratum_thickness;

— name;

— specification;

— stratum_material.

4.2.702.1 laminate_stiffness_class

The laminate_stiffness_class specifies either a conformal_coat, a fluid_like, or a stiff_laminate stiffness class of which the Stratum_technology is a member. The laminate_stiffness_class need not be specified for a particular Stratum_technology.

4.2.702.2 maximum_feature_size_requirement

The maximum_feature_size_requirement specifies the maximum Length_data_element (see 4.2.422) of any feature of the Stratum (see 4.2.677). The maximum_feature_size_requirement need not be specified for a particular Stratum_technology.

4.2.702.3 maximum_stratum_thickness

The maximum_stratum_thickness specifies the maximum Length_data_element (see 4.2.422) for the thickness of the Stratum_technology.

4.2.702.4 minimum_finished_feature_size

The minimum_finished_feature_size specifies one role of the Length_data_element (see 4.2.422) of any feature of the Stratum (see 4.2.677). The minimum_finished_feature_size need not be specified for a particular Stratum_technology.

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4.2.702.5 minimum_finished_feature_spacing

The minimum_finished_feature_spacing specifies one role of the Length_data_element (see 4.2.422) of any feature of the Stratum (see 4.2.677). The minimum_finished_feature_spacing need not be specified for a particular Stratum_technology.

4.2.702.6 minimum_stratum_thickness

The minimum_stratum_thickness specifies the minimum Length_data_element (see 4.2.422) for the thickness of the Stratum_technology.

4.2.702.7 name

The name specifies the alphanumeric identifier of a Stratum_technology.

4.2.702.8 specification

The specification specifies the role of the Process_specification (see 4.2.589) for the Stratum_technology. The specification need not be specified for a particular Stratum_technology.

4.2.702.9 stratum_material

The stratum_material specifies the role of the Ee_material (see 4.2.273) for the Stratum_technology.

Constraints:

UR1: The name shall be unique within a population of Stratum_technologies.

4.2.703 Stratum_technology_line_width_tolerance_assignment

A Stratum_technology_line_width_tolerance_assignment is a type of Managed_design_object (see 4.2.431) that characterizes the line width range that is possible to be manufactured efficiently and effectively for a particular Stratum_technology (see 4.2.702).

The data associated with a Stratum_technology_line_width_tolerance_assignment are the following:

— characterized_stratum_technology;

— design_definition;

— maximum_negative_deviation;

— maximum_positive_deviation;

— tolerance_line_width_class.

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4.2.703.1 characterized_stratum_technology

The characterized_stratum_technology specifies the role of the Stratum_technology (see 4.2.702) for the Stratum_technology_line_width_tolerance_assignment.

4.2.703.2 design_definition

The design_definition specifies the role of the Interconnect_module (see 4.2.372) for the Stratum_technology_line_width_tolerance_assignment.

4.2.703.3 maximum_negative_deviation

The maximum_negative_deviation specifies the largest negative Length_data_element (see 4.2.422) for the Stratum_technology_line_width_tolerance_assignment.

4.2.703.4 maximum_positive_deviation

The maximum_positive_deviation specifies the largest positive Length_data_element (see 4.2.422) for the Stratum_technology_line_width_tolerance_assignment.

4.2.703.5 tolerance_line_width_class

The tolerance_line_width_class specifies the role of the Line_width_class (see 5.2.4.377) for the Stratum_technology_line_width_tolerance_assignment.

4.2.704 Structured_text

A Structured_text is a type of Managed_design_object (see 4.2.431). A Structured_text is a portion of an Ee_document (see 4.2.271) that may have identifiable relations between itself and other portions of the Ee_document. Those relations are a container relationship in which the Structured_text is "contained in" an Ee_document, or a sequential relationship in which the Structured_text may be in a specific sequence of Structured_text within an Ee_document. Structured_text may be composed of other instances of Structured_text or Ee_text as content, in a tree structure. A Structured_text shall be acyclic. The Structured_text should at least provide content at the lowest level of the structure.

NOTE This part of ISO 10303 is exchanging the content of a document, not its presentation format.

EXAMPLE 1 An example of Structured_text is an extract from an Ee_document in SGML, in which each portion of the Ee_document has a known structure.

EXAMPLE 2 Structured_text objects can be chapters, titles, paragraphs, sentences or structured markup.

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The data associated with a Structured_text are the following:

— content_markup;

— plain_text_content;

— precedent_structured_text;

— structured_text_content.

4.2.704.1 content_markup

The content_markup specifies the role of the External_definition (see 4.2.304) for the Structured_text. The content_markup identifies the computer interpretable element type of the content. Plain text shall be a string encoded according to clause 7.3.3 of ISO 10303-21. Plain text shall be identified by the following contents of the External_definitiion referenced by content_markup: code is "text markup tag", code_value is "plain text", reference_document is "ISO 10303-210".

EXAMPLE 1 An html encoded structure in accordance with HTML 3.2 would reference an External_definition with the following contents: code is "html tag", code_value is "body", reference_document is "!DOCTYPE HTML PUBLIC "-//W3C/DTD HTML 3.2//EN"". This example encloses the required content of a ISO 10303-21 exchange file with quotation marks (").

4.2.704.2 plain_text_content

The plain_text_content specifies the role of the Ee_text for the Structured_text. The plain_text_content need not be provided for the Structured_text.

NOTE Plain_text_content would only not be provided if there was a need to specify lower level markup within the current markup.

4.2.704.3 precedent_structured_text

The precedent_structured_text specifies the role of the Structured_text for the Structured_text. This role is appropriate when both Structured_text are helping to compose a higher level Structured_text or are referenced by an Ee_document (see 4.2.271). The precedent_structured_text need not be provided for a Structured_text.

NOTE Precedent_structured_text is provided to ensure the correct sequencing of text contents.

4.2.704.4 structured_text_content

The structured_text_content specifies the role of the Structured_text for the Structured_text. There may be one or more entries in the structured_text_content for a particular Structured_text. The structured_text_content need not be provided for the Structured_text.

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NOTE Structured_text_content would only not be provided if there was no need to specify lower level markup within the current markup or if plain_text_content were provided.

4.2.705 Styled_curve_occurrence

A Styled_curve_occurrence is a type of Managed_design_object (see 4.2.431). A Styled_curve_occurrence is an occurrence of a curve with specific parametric styling assigned.

The data associated with a Styled_curve_occurrence are the following:

— of_curve_style;

— styled_curve.

4.2.705.1 of_curve_style

The of_curve_style specifies the Curve_style (see 5.2.4.253) to apply to the Curve (see 4.2.165) for the Styled_curve_occurrence.

4.2.705.2 styled_curve

The styled_curve specifies the role of the Curve (see 4.2.165) for the Styled_curve_occurrence.

4.2.706 Styled_text

A Styled_text is a type of Feature_shape_definition (see 4.2.315) that is formatted text that appears in the material in a Interconnect_module (see 4.2.372). The text shall be styled by font. The definition specifies font styling that shall be applied to realized characters. Externally defined text font and font family are supported.

NOTE This part of ISO 10303 does not standardize the display of text on computer systems.

EXAMPLE 1 Figure 104 illustrates styling that may be applied to text that appears in the material. The principal styling supported is font size through the bounding box specification. The other variations illustrated in the figure occur through modification of the text orientation during placement, and may require grouping of the text with other shape data. Some of the justification and orientation capability portrayed in the figure is provided by the Laminate_text_string_component (see 4.2.406)

The data associated with a Styled_text are the following:

— text_font.

4.2.706.1 text_font

The text_font specifies either the Font_definition (see 5.2.4.341) or the Registered_font (see 4.2.610) for the Styled_text.

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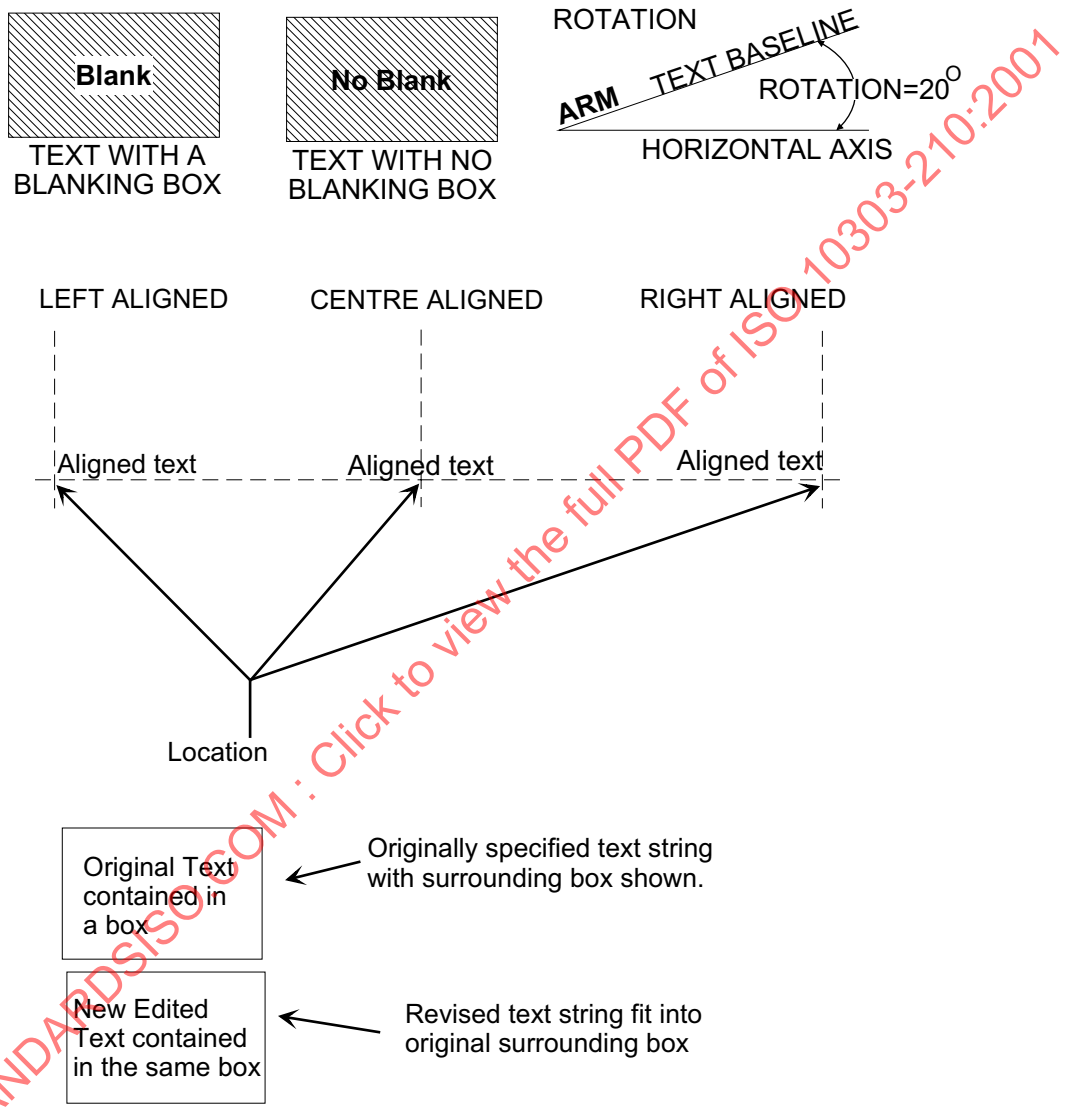

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Figure 104 – Styled_text

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4.2.707 Sub_assembly_relationship

A Sub_assembly_relationship is a type of Managed_design_object (see 4.2.431). A Sub_assembly_-relationship is an association that specifies a subassembly constraint among two or more Assembly_-component (see 4.2.27) that is aggregated into an Assembly_group_component (see 4.2.31).

NOTE Industrial practice is to associate the parts included in a Assembly_group_component with members of Product_association (see 4.2.590).

EXAMPLE 1 Figure 105 illustrates a detail of an assembly drawing that shows components grouped into a sub-assembly, and the corresponding list of items and their associated reference_designations.

The data associated with a Sub_assembly_relationship are the following:

— related_components;

— relating_component.

4.2.707.1 related_components

The related_components specify the dependent Assembly_component (see 4.2.27) of the Sub_assembly_relationship. There shall be two or more Assembly_component for a Sub_assembly_relationship.

4.2.707.2 relating_component

The relating_component specifies the independent Assembly_group_component (see 4.2.31) which is the aggregation of two or more Assembly_component (see 4.2.27) specified by related_components.

Constraints:

WR1: An Assembly_component specified as a relating_component shall not appear in the chain of components in the set of Assembly_component specified by related_components.

4.2.708 Substitute_product

A Substitute_product is a type of Managed_design_object (see 4.2.431). A Substitute_product is an Ee_-product (see 4.2.274) that may be substituted for another Ee_product within the context of an assembly or for a specific instance within an assembly. The Substitute_product is a one-way substitution only. Two instances of Substitute_product are required to support the declaration of a totally equivalent substitution relationship.

NOTE Two different substitutes may be defined within the same assembly for the same base product based on the different usages of that base product within that assembly.

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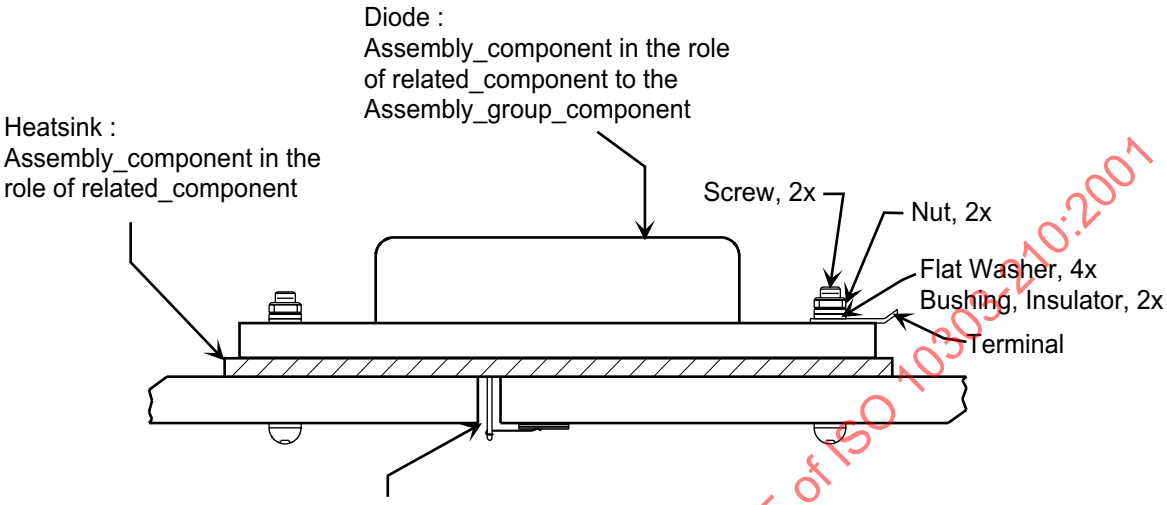

Note - The mounting hardware (screw, nut, washer, bushing, terminal) individually fill the role of related_component.

A Sub_assembly_relationship relates an Assembly_component with the Assembly_group_component to which it is associated.

Items in the List	Reference Designator
Heatsink	H1
Diode	ZR1
Screw	S1
Screw	S2
Nut	N1
Nut	N2
Washer	W1
Bushing	B1
Terminal	T1
Washer	W2
Washer	W3
Washer	W4
Bushing	B2
Washer	W5

Figure 105 – Sub_assembly_relationship

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The data associated with a Substitute_product are the following:

— defined_alternate_product;

— substitutable_component.

4.2.708.1 defined_alternate_product

The defined_alternate_product specifies the role of the Ee_product (see 4.2.274) for the Substitute_product. There shall be one or more Ee_product for the Substitute_product.

4.2.708.2 substitutable_component

The substitutable_component specifies the role of the Assembly_composition_relationship (see 4.2.30) for the Substitute_product.

4.2.709 Supplied_product_version

A Supplied_product_version is a type of Managed_design_object (see 4.2.431). The Supplied_product_version is a product that is obtained from an external source (the supplier).

The data associated with a Supplied_product_version are the following:

— required_certification;

— supplied_product_version;

— supplied_product_version_approval;

— supplier;

— supplier_part_number.

4.2.709.1 required_certification

The required_certification is an inverse relationship that specifies the Certification (see 4.2.73) that specifies the Supplied_product_version as its certified_product_version. There shall be no more than one Certification for a Supplied_product_version.

4.2.709.2 supplied_product_version

The supplied_product_version specifies the role of the Ee_product_version (see 4.2.282) for the Supplied_product_version.

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4.2.709.3 supplied_product_version_approval

The supplied_product_version_approval specifies the role of the Ee_approval (see 4.2.269) for the Supplied_product_version.

4.2.709.4 supplier

The supplier specifies the Organization (see 5.2.4.135) that supplies the Supplied_product_version.

4.2.709.5 supplier_part_number

The supplier_part_number specifies the name of the Supplied_product_version. The supplier_part_number need not be provided for a particular Supplied_product_version.

Constraints:

UR1: The combination of the supplier and the supplier_part_number shall be unique within a population of Supplied_product_versions.

4.2.710 Surface_finish_specification

A Surface_finish_specification is a type of Material_specification (see 5.2.4.93) that is a collection of the properties applicable to surface textures or coatings either for a product in-process or a completed product.

4.2.711 Surface_prepped_terminal

A Surface_prepped_terminal is a type of Altered_package_terminal (see 4.2.6) that defines a modification to its surface condition, for solderability or other reasons, prior to its installation on an Interconnect_module_component (see 4.2.373) during the assembly of a Pca (see 4.2.510).

The data associated with a Surface_prepped_terminal are the following:

— surface_preparation.

4.2.711.1 surface_preparation

The surface_preparation specifies the Surface_finish_specification (see 4.2.710) for modification to the surface finish of the Surface_prepped_terminal.

4.2.712 Symmetrical_tolerance_characteristic

A Symmetrical_tolerance_characteristic is a type of Tolerance_characteristic (see 5.2.4.168) that has symmetrical tolerances around the nominal value.

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The data associated with a Symmetrical_tolerance_characteristic are the following:

— component_characteristic.

4.2.712.1 component_characteristic

The component_characteristic specifies the value of the Numeric_parameter (see 4.2.460) for the Symmetrical_tolerance_characteristic. There shall be exactly two Numeric_parameter for the Symmetrical_tolerance_characteristic.

4.2.713 Symmetry_tolerance

A Symmetry_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on the symmetry of a Shape_element (see 4.2.645) with respect to a Datum_plane (see 5.2.4.129). That is, the median points of all opposed or correspondingly located elements of two or more surfaces of a Shape_element must fall within the defined Tolerance_zone_boundary (see 4.2.734). The Tolerance_zone_boundary is an opposing plane set that is symmetrically disposed about the specified Datum_plane.

NOTE Symmetry tolerance is defined in terms of tolerance zone definitions in 17.12 of ISO/DIS 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Centre_plane.

NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: There shall be at most two Datum in the Datum_system the definition of which is specified by the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

WR3: There shall be a Datum_plane in the Datum_system the definition of which is specified by the datum_system_definition.

WR4: The Symmetry_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_size.

IP1: The form of the toleranced Shape_element shall be consistent with the form of a shape element for which the application of a symmetry tolerance is sensible.

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4.2.714 Tangent_plane

A Tangent_plane is a type of Tangent_shape_element (see 5.2.4.297) that is planar in form.

EXAMPLE 1 An Angularity_tolerance (see 4.2.20) might be applied to the Tangent_plane derived from a surface of a Physical_unit (see 4.2.533), as opposed to the surface itself, if variations in the form of the surface are unimportant or are sufficiently constrained by other tolerances.

Constraints:

IP1: The form of the Shape_element from which the Tangent_plane is derived shall be consistent with the form of a shape element from which a tangent plane can be derived.

4.2.715 Tangent_shape_element

A Tangent_shape_element is a type of Derived_shape_element (see 4.2.221) that is either a straight line that contacts a curve at only the high points or is a plane that contacts a surface at only its high points. The Shape_element from which the Tangent_shape_element is derived is associated with the Tangent_shape_element by the Shape_element_deriving_relationship (see 4.2.649) that is specified as the deriving_relationships. A Tangent_shape_element may be a Tangent_plane (see 5.2.4.73).

NOTE The attribute deriving_relationships is declared in the Derived_shape_element entity of which this entity is a subtype.

Constraints:

WR1: The Tangent_shape_element shall be derived from only one Shape_element.

IP1: The Shape_element from which the Tangent_shape_element is derived shall be a curve or surface.

4.2.716 Technology

A Technology is a type of Managed_design_object (see 4.2.431). A Technology is the manufacturing process for the realization of an Ee_product (see 4.2.274).

The data associated with a Technology are the following:

— classification;

— material_product_system;

— process_technology.

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4.2.716.1 classification

The classification specifies the External_definition (see 4.2.304) which defines the Technology.

4.2.716.2 material_product_system

The material_product_system specifies the Ee_material (see 4.2.273) which defines the material combination which is necessary for the output of the manufacturing process.

4.2.716.3 process_technology

The process_technology specifies the Process_specification (see 4.2.589) which defines the exact process of the Technology.

4.2.717 Terminal_pair_port_equivalence_relationship

A Terminal_pair_port_equivalence_relationship is a type of Managed_design_object (see 4.2.431). A Terminal_pair_port_equivalence_relationship is the assignment association between a pair of scalar ports and a single distributed port.

The data associated with a Terminal_pair_port_equivalence_relationship are the following:

— equivalent_port;

— scalar_ports.

4.2.717.1 equivalent_port

The equivalent_port specifies the Analytical_model_port (see 4.2.11) that represents the single distributed port for the Terminal_pair_port_equivalence_relationship.

4.2.717.2 scalar_ports

The scalar_ports specify the two Analytical_model_scalar_port (see 4.2.13) in the ordered sequence for the Terminal_pair_port_equivalence_relationship. The second scalar_port is always the reference port. Other details depend on the specific domain of the Analytical_model (see 4.2.10).

EXAMPLE 1 Port "INPUT" of a microwave coaxial filter model is the equivalent_port for this example.

Port "INPUT center pin" is the first Analytical_model_scalar_port for this example. Port "INPUT shield" is the second Analytical_model_scalar_port for this example.

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Constraints:

WR1: The distributed_properties attribute of the Analytical_model_port in the role of equivalent_port shall be "TRUE".

WR2: The scalar_ports and equivalent_port shall not reference the same Analytical_model.

WR3: The scalar_ports shall reference the same Analytical_model.

WR4: The equivalent_port shall not be a member of Digital_analytical_model_port.

4.2.718 Terminal_swap_specification

A Terminal_swap_specification is a type of Change_design_object_management_relationship (see 4.2.74). The Terminal_swap_specification is part of the swapping specification from the previous design definition to the current design definition. It identifies the terminal in the previous design that was connected to a node, and the terminal in the current design that is connected to that node instead.

NOTE With the pin mapping between the functional and physical representations in the library, this is sufficient information to derive the swapping at the component terminal; however, note that this is in the previous and present design definitions and not in the library functional definition.

The data associated with a Terminal_swap_specification are the following:

— current_design_object;

— previous_design_object.

4.2.718.1 current_design_object

The current_design_object specifies the Functional_unit_terminal_node_assignment (see 5.2.4.337) of the terminal node after the swap for the Terminal_swap_specification.

4.2.718.2 previous_design_object

The previous_design_object specifies the Functional_unit_terminal_node_assignment (see 5.2.4.337) of the terminal node before the swap for the Terminal_swap_specification.

Constraints:

WR1: The current_design_object shall not be the previous_design_object.

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4.2.719 Termination_constraint

A Termination_constraint is a type of Managed_design_object (see 4.2.431). A Termination_constraint is a constraint that requires a set of two or more Mating_connector_termination (see 5.2.5.4) to satisfy an Ee_requirement_occurrence (see 4.2.283).

The data associated with a Termination_constraint are the following:

— constrained_termination;

— termination_usage_constraint.

4.2.719.1 constrained_termination

The constrained_termination specifies the role of the Mating_connector_termination (see 5.2.5.4) for the Termination_constraint. There shall be two or more Mating_connector_termination for the Termination_constraint.

4.2.719.2 termination_usage_constraint

The termination_usage_constraint specifies the role of the Ee_requirement_occurrence (see 4.2.283) for the Termination_constraint.

4.2.720 Test_select_product

A Test_select_product is a type of Alternate_select_product (see 4.2.9) in which the selection among alternate choices is performed as a result of a test operation, in order to optimize the performance of the Ee_product (see 4.2.274).

4.2.721 Test_specification

A Test_specification is a type of Ee_specification (see 4.2.292) that provides information about the physical or functional testing of an Ee_product (see 4.2.274).

4.2.722 Theoretically_exact_dimension_representation

A Theoretically_exact_dimension_representation is a type of Singular_dimension_representation (see 4.2.663) that describes the theoretically exact size, form, orientation, or location of one or more Shape_element (see 4.2.645).

NOTE 1 Theoretically exact dimensions are described in clause 10 of ISO 1101.

NOTE 2 The term in ASME Y14.5M corresponding to Theoretically_exact_dimension_representation is basic dimension. Basic dimensions are defined in 1.3.9 of ASME Y14.5M.

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4.2.723 Thermal_component

A Thermal_component is a type of Assembly_component (see 4.2.27) that is included in the design in order to satisfy a heat flow requirement.

NOTE An Assembly_component utilized as a Thermal_component may be another type of Assembly_component as well.

EXAMPLE 1 Examples of Thermal_component are: a heatsink, a thermal via, an active thermal cooler (such as a fan), or a thermoelectric cooler.

4.2.724 Thermal_feature

A Thermal_feature is a type of Part_feature (see 4.2.494) that is specified as having a role in the exchange of heat with the application environment of the Physical_unit (see 4.2.533).

4.2.725 Thermal_isolation_removal_structure

A Thermal_isolation_removal_structure is a type of Filled_area_material_removal_structure (see 5.2.4.101) included in the design for reasons of thermal isolation.

EXAMPLE 1 Figure 106 illustrates the removal of material from a power plane based on the shape of this structure.

The data associated with a Thermal_isolation_removal_structure are the following:

— thermal_isolation_spacing_requirement.

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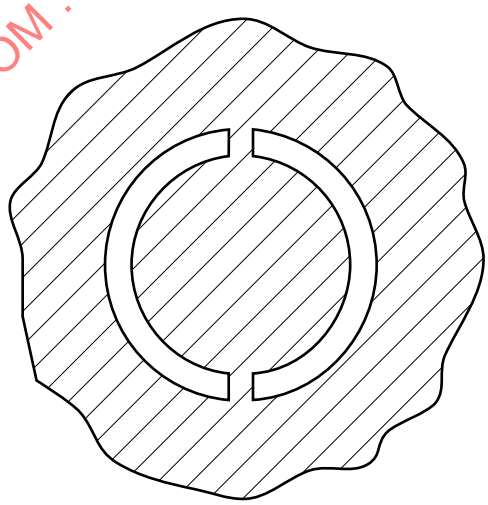

Figure 106 – Thermal_isolation_removal_structure

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4.2.725.1 thermal_isolation_spacing_requirement

The thermal_isolation_spacing_requirement is an inverse relationship that specifies that the existence of the Thermal_isolation_removal_structure is dependent on the existence of the Thermal_isolation_requirement_assignment (see 4.2.726) that specifies the Thermal_isolation_removal_structure as its resulting_structure.

4.2.726 Thermal_isolation_requirement_assignment

A Thermal_isolation_requirement_assignment is a type of Managed_design_object (see 4.2.431). A Thermal_isolation_requirement_assignment is the relationship among requirements for thermal isolation and the resulting structure of the Interconnect_module (see 4.2.372).

The data associated with a Thermal_isolation_requirement_assignment are the following:

— angular_orientation_requirement;

— effective_current_capacity_requirement;

— resulting_structure;

— thermal_isolation_spacing_requirement.

4.2.726.1 angular_orientation_requirement

The angular_orientation_requirement specifies one role of the Ee_requirement_occurrence (see 4.2.283) for the Thermal_isolation_requirement_assignment.

4.2.726.2 effective_current_capacity_requirement

The effective_current_capacity_requirement specifies one role of the Ee_requirement_occurrence (see 4.2.283) for the Thermal_isolation_requirement_assignment.

4.2.726.3 resulting_structure

The resulting_structure specifies the role of the Thermal_isolation_removal_structure (see 5.2.4.325) for the Thermal_isolation_requirement_assignment.

4.2.726.4 thermal_isolation_spacing_requirement

The thermal_isolation_spacing_requirement specifies one role of the Ee_requirement_occurrence (see 4.2.283) for the Thermal_isolation_requirement_assignment.

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4.2.727 Thermal_network_definition

A Thermal_network_definition is a type of Functional_unit_network_definition (see 5.2.4.339) for which the network nodal formulation is a representation of heat flow rather than current flow.

4.2.728 Thermal_requirement_allocation

A Thermal_requirement_allocation is a type of Assembly_requirement_allocation (see 4.2.40) for which the Ee_requirement_occurrence (see 4.2.283) has thermal characteristics. A Thermal_requirement_allocation is the relationship between the Thermal_requirement_occurrence (see 5.2.4.21) and the Thermal_component (see 4.2.723) that satisfies it.

The data associated with a Thermal_requirement_allocation are the following:

— assembly_assignment;

— requirement.

4.2.728.1 assembly_assignment

The assembly_assignment specifies the role of the Thermal_component (see 4.2.723) for the Thermal_requirement_allocation.

4.2.728.2 requirement

The requirement specifies the role of the Thermal_requirement_occurrence (see 5.2.4.21) for the Thermal_requirement_allocation.

4.2.729 Thermal_requirement_occurrence

A Thermal_requirement_occurrence is a type of Ee_requirement_occurrence (see 4.2.283) that specifies a heat transfer related requirement.

4.2.730 Tolerance_characteristic

A Tolerance_characteristic is a type of Coordinated_characteristic (see 5.2.4.383). A Tolerance_characteristic may be one of Maximum_tolerance_characteristic (see 4.2.446), Minimum_tolerance_characteristic (see 4.2.450), Plus_minus_tolerance_characteristic (see 4.2.555), Statistical_tolerance_characteristic (see 4.2.674), or Symmetrical_tolerance_characteristic (see 4.2.712).

The data associated with a Tolerance_characteristic are the following:

— component_characteristic.

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4.2.730.1 component_characteristic

The component_characteristic specifies the role of the Numeric_parameter (see 4.2.460) for the Tolerance_characteristic. There shall be one or more Numeric_parameter for the Tolerance_characteristic.

NOTE Members of this application object are not exchanged to support geometric tolerancing.

4.2.731 Tolerance_specific_restraint_condition

The Tolerance_specific_restraint_condition is a type of Restraint_condition that is only applied to specified instances of Geometric_tolerance (see 5.2.4.386) and Dimensional_characteristic (see 4.2.256).

The data associated with a Tolerance_specific_restraint_condition are the following:

— affected_tolerances.

4.2.731.1 affected_tolerances

The affected_tolerances specifies the Geometric_tolerance (see 5.2.4.386) and Dimensional_characteristic (see 4.2.256) to which the restraint condition applies. There shall be one or more Geometric_tolerance or Dimensional_characteristic specified as the affected_tolerances by a Tolerance_specific_restraint_condition.

4.2.732 Tolerance_zone

A Tolerance_zone is a type of Non_feature_shape_element (see 5.2.4.127) that is a region within which the toleranced Shape_element (see 4.2.645) must lie.

NOTE Tolerance zones are defined in clause 7 of ISO 1101.

The data associated with a Tolerance_zone are the following:

— zone_boundary;

— zone_definition.

4.2.732.1 zone_boundary

The zone_boundary specifies the Tolerance_zone_boundary (see 4.2.734) that define the limits of the Tolerance_zone.

4.2.732.2 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Tolerance_zone is dependent on the existence of the Tolerance_zone_definition (see 4.2.739) that specifies the Tolerance_zone as its defined_tolerance_zone.

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4.2.733 Tolerance_zone_and_viewing_plane_orienting_relationship

A Tolerance_zone_and_viewing_plane_orienting_relationship is a type of Managed_design_object (see 4.2.431). A Tolerance_zone_and_viewing_plane_orienting_relationship is a relationship that associates a Tolerance_zone (see 4.2.732) with the Viewing_plane (see 4.2.769) by which it is oriented.

The data associated with a Tolerance_zone_and_viewing_plane_orienting_relationship are the following:

— oriented_tolerance_zone;

— orienting_viewing_plane;

— zone_orientation.

4.2.733.1 oriented_tolerance_zone

The oriented_tolerance_zone specifies the Tolerance_zone (see 4.2.732) that is oriented with respect to the Viewing_plane (see 4.2.769) specified as the orienting_viewing_plane.

4.2.733.2 orienting_viewing_plane

The orienting_viewing_plane specifies the Viewing_plane (see 4.2.769) by which the Tolerance_zone (see 4.2.732) that is specified as the oriented_tolerance_zone is oriented.

4.2.733.3 zone_orientation

The zone_orientation is an inverse relationship that specifies that the existence of the Tolerance_zone_and_viewing_plane_orienting_relationship is dependent on the existence of the Viewing_plane_based_orientation (see 4.2.770) that specifies the Tolerance_zone_and_viewing_plane_orienting_relationship as its orienting_relationship.

4.2.734 Tolerance_zone_boundary

A Tolerance_zone_boundary is a type of Non_feature_shape_element (see 5.2.4.127) that is a boundary of a Tolerance_zone (see 4.2.732). A Tolerance_zone_boundary is one of a Conical_tolerance_zone_boundary (see 5.2.4.140), a Tolerance_zone_circular_or_cylindrical_or_spherical_boundary (see 5.2.4.336), or a Tolerance_zone_opposing_boundary_set (see 4.2.745).

EXAMPLE 1 A pair of opposing planes may form a Tolerance_zone_boundary.

The data associated with a Tolerance_zone_boundary are the following:

— boundary_zone_definition;

— bounded_zone.

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4.2.734.1 boundary_zone_definition

The boundary_zone_definition is an inverse relationship that specifies that the existence of the Tolerance_zone_boundary is dependent on the existence of the Tolerance_zone_boundary_definition (see 4.2.735) that specifies the Tolerance_zone_boundary as its defined_zone_boundary.

4.2.734.2 bounded_zone

The bounded_zone is an inverse relationship that specifies that the existence of the Tolerance_zone_boundary is dependent on the existence of the Tolerance_zone (see 4.2.732) that specifies the Tolerance_zone_boundary as its zone_boundary.

4.2.735 Tolerance_zone_boundary_definition

A Tolerance_zone_boundary_definition is a type of Managed_design_object (see 4.2.431) that characterizes a Tolerance_zone_boundary (see 4.2.734). A Tolerance_zone_boundary_definition is either a Boundary_zone_definition_with_specified_size (see 4.2.61) or a Conical_tolerance_zone_boundary_definition (see 5.2.4.347).

The data associated with a Tolerance_zone_boundary_definition are the following:

— defined_zone_boundary;

— zone_definition.

4.2.735.1 defined_zone_boundary

The defined_zone_boundary specifies the Tolerance_zone_boundary (see 4.2.734) that is characterized by the Tolerance_zone_boundary_definition.

4.2.735.2 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Tolerance_zone_boundary_definition is dependent on the existence of the Tolerance_zone_definition (see 4.2.739) that specifies the Tolerance_zone_boundary_definition as its boundary_definition.

4.2.736 Tolerance_zone_boundary_member

A Tolerance_zone_boundary_member is a type of Non_feature_shape_element (see 5.2.4.127) that is one of the two explicitly identified members of a Tolerance_zone_explicit_opposing_boundary_set (see 4.2.742).

The data associated with a Tolerance_zone_boundary_member are the following:

— explicit_opposing_boundary_set.

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4.2.736.1 explicit_opposing_boundary_set

The explicit_opposing_boundary_set is an inverse relationship that specifies that the existence of the Tolerance_zone_boundary_member is dependent on the existence of the Tolerance_zone_explicit_opposing_boundary_set (see 4.2.742) that specifies the Tolerance_zone_boundary_member as one of its boundary_members.

EXAMPLE 1 Tolerance_zone_boundary_members may be used to specify an unequally disposed profile tolerance (i.e., either a Profile_of_any_line_tolerance (see 5.2.4.41) or Profile_of_any_surface_tolerance).

Constraints:

WR1: The Tolerance_zone_boundary_member shall not be specified as the offset_tolerance_zone_boundary_member by more than one Tolerance_zone_boundary_member_offset.

4.2.737 Tolerance_zone_boundary_member_offset

A Tolerance_zone_boundary_member_offset is a type of Managed_design_object (see 4.2.431). A Tolerance_zone_boundary_member_offset is a definition that characterizes the size and direction that a Tolerance_zone_boundary_member (see 4.2.736) is offset from the True_profile (see 4.2.753) of the toleranced Physical_feature_or_part_template (see 4.2.527).

The data associated with a Tolerance_zone_boundary_member_offset are the following:

— boundary_definition;

— offset_tolerance_zone_boundary_member;

— offset_value;

— type_of_offset.

4.2.737.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the Tolerance_zone_boundary_member_offset is dependent on the existence of the Profile_boundary_definition_with_offsets (see 4.2.592) that specifies the Tolerance_zone_boundary_member_offset as one of its boundary_offsets.

4.2.737.2 offset_tolerance_zone_boundary_member

The offset_tolerance_zone_boundary_member specifies the Tolerance_zone_boundary_member (see 4.2.736) the offset of which is characterized by the Tolerance_zone_boundary_member_offset.

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4.2.737.3 offset_value

The offset_value specifies the Length_data_element (see 4.2.422) that represents distance the Tolerance_zone_boundary_member (see 4.2.736) is offset from the True_profile (see 4.2.753).

4.2.737.4 type_of_offset

The type_of_offset specifies a label that indicates the direction that the Tolerance_zone_boundary_member (see 4.2.736) is offset from the True_profile (see 4.2.753). The type_of_offset shall either be "away_from_material" or "towards_material".

Constraints:

WR1: The Tolerance_zone_explicit_opposing_boundary_set that is specified as the explicit_opposing_boundary_set by the Tolerance_zone_boundary_member that is specified as the offset_tolerance_zone_boundary_member shall be the same instance of Tolerance_zone_explicit_opposing_boundary_set that is specified as the defined_zone_boundary by the Profile_boundary_definition_with_offsets specified as the boundary_definition.

4.2.738 Tolerance_zone_circular_or_cylindrical_or_spherical_boundary

A Tolerance_zone_circular_or_cylindrical_or_spherical_boundary is a type of Tolerance_zone_boundary (see 4.2.734) that is circular, cylindrical, or spherical in form. The actual form of the Tolerance_zone_boundary is dictated by the type of tolerance and the form of the toleranced Shape_element .

The data associated with a Tolerance_zone_circular_or_cylindrical_or_spherical_boundary are the following:

— size_characteristic.

4.2.738.1 size_characteristic

A size_characteristic is an inverse relationship that specifies that the existence of the Tolerance_zone_circular_or_cylindrical_or_spherical_boundary is dependent on the existence of the Diametrical_boundary_size_characteristic (see 4.2.245) that specifies the Tolerance_zone_circular_or_cylindrical_or_spherical_boundary as its sized_boundary.

EXAMPLE 1 A cylindrical Tolerance_zone_boundary (see 4.2.734) could be defined by a position tolerance applied to an axis of a cylindrical hole.

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4.2.739 Tolerance_zone_definition

A Tolerance_zone_definition is a type of Managed_design_object (see 4.2.431). A Tolerance_zone_definition may be a one of Conical_tolerance_zone_definition (see 5.2.4.352), Projected_tolerance_zone_definition (see 4.2.601), Runout_tolerance_zone_definition_with_specified_angle (see 4.2.636), or Tolerance_zone_definition_with_per_unit_size_specification (see 5.2.4.47). Additionally, a Tolerance_zone_definition may be a Tolerance_zone_definition_with_specified_orientation (see 4.2.741). A Tolerance_zone_definition is a definition that characterizes a Tolerance_zone (see 4.2.732).

The data associated with a Tolerance_zone_definition are the following:

— boundary_definition;

— defined_tolerance_zone;

— form.

4.2.739.1 boundary_definition

The boundary_definition specify the Tolerance_zone_boundary_definition (see 4.2.735) that defines the limits of the Tolerance_zone (see 4.2.732) for the Tolerance_zone_definition.

4.2.739.2 defined_tolerance_zone

The defined_tolerance_zone specifies the Tolerance_zone (see 4.2.732) that is characterized by the Tolerance_zone_definition.

4.2.739.3 form

The form specifies the Tolerance_zone_form (see 4.2.743) that characterizes the form of the specified Tolerance_zone (see 4.2.732). The form need not be specified for a particular Tolerance_zone_definition.

Constraints:

WR1: If the Tolerance_zone_form is specified, the Tolerance_zone specified as the characterized_tolerance_zone of the Tolerance_zone_form that is specified as the form shall be the same instance of Tolerance_zone as specified as the defined_tolerance_zone.

WR2: The Tolerance_zone_boundary specified as the defined_zone_boundary of the Tolerance_zone_boundary_definition that is specified as the boundary_definition shall be the same instances of Tolerance_zone_boundary as specified as the zone_boundary of the Tolerance_zone specified as the defined_tolerance_zone.

WR3: If the Tolerance_zone_definition is not a Conical_tolerance_zone_definition, the Tolerance_zone_definition shall be specified as the tolerance_zone_or_boundary_definition by exactly one Geometric_tolerance.

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4.2.740 Tolerance_zone_definition_with_per_unit_size_specification

A Tolerance_zone_with_per_unit_size_specification is a type of Tolerance_zone_definition (see 4.2.739) in which the extent of the Tolerance_zone (see 4.2.732) is defined. A Tolerance_zone_with_per_unit_-size_specification is used to define a Tolerance_zone when the design requirements are such that abrupt variations in the toleranced Shape_element (see 4.2.645) must be limited. In essence, the thickness, or the diameter, of the Tolerance_zone is defined by the Boundary_size_characteristic (see 4.2.60) and the extent is defined by the Tolerance_zone_per_unit_size_specification (see 4.2.746). Each element of the toleranced Shape_element that has the same extent as the Tolerance_zone must lie within the Tolerance_-zone when the Tolerance_zone is positioned coincident with the element.

The data associated with a Tolerance_zone_definition_with_per_unit_size_specification are the follow-ing:

— per_unit_size_specification.

4.2.740.1 per_unit_size_specification

The per_unit_size_specification specifies the Tolerance_zone_per_unit_size_specification (see 4.2.746) that defines the extent of the specified Tolerance_zone (see 4.2.732) for the Tolerance_zone_definition_-with_per_unit_size_specification.

EXAMPLE 1 A Straightness_tolerance may be applied on a per unit basis such that every 100 mm length of a toleranced axis must lie within a Tolerance_zone that is bounded by a cylindrical Tolerance_zone that is 3 mm in diameter.

Constraints:

WR1: The Tolerance_zone specified as the defined_tolerance_zone shall be the same instance of Toler-ance_zone as specified as the specified_tolerance_zone by the Tolerance_zone_per_unit_size_specifica-tion that is specified as the per_unit_size_specification.

NOTE The attribute defined_tolerance_zone is declared in the Tolerance_zone_definition entity of which this entity is a subtype.

WR2: The Geometric_tolerance that specifies the Tolerance_zone_definition_with_per_unit_size_spec-ification as the tolerance_zone_or_boundary_definition shall be one of Flatness_tolerance, Straight-ness_tolerance, Angularity_tolerance, Parallelism_tolerance, or Perpendicularity_tolerance.

4.2.741 Tolerance_zone_definition_with_specified_orientation

A Tolerance_zone_definition_with_specified_orientation is a type of Tolerance_zone_definition (see 4.2.739) in which the orientation of the Tolerance_zone (see 4.2.732) is specified.

The data associated with a Tolerance_zone_definition_with_specified_orientation are the following:

— zone_orientation.

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4.2.741.1 zone_orientation

The zone_orientation specifies either a Viewing_plane_based_orientation (see 4.2.770), a Datum_axis_-related_orientation (see 5.2.4.139), or a Datum_based_vector_orientation (see 4.2.182) for the Tolerance_zone_definition_with_specified_orientation.

Constraints:

WR1: If a Datum_axis_related_orientation is specified as the zone_orientation, the Tolerance_zone specified as the defined_tolerance_zone shall be the same instance of Tolerance_zone as specified as the oriented_tolerance_zone by the Datum_axis_and_tolerance_zone_orienting_relationship that is specified as the orienting_relationship by the Datum_axis_related_orientation that is specified as the zone_-orientation.

WR2: If a Viewing_plane_based_orientation is specified as the zone_orientation, the Tolerance_zone specified as the defined_tolerance_zone shall be the same instance of Tolerance_zone as specified as the oriented_tolerance_zone by the Tolerance_zone_and_viewing_plane_orienting_relationship that is specified as the orienting_relationship by the Viewing_plane_based_orientation that is specified as the zone_orientation.

WR3: The Tolerance_zone_definition_with_specified_orientation shall not be specified as a tolerance_-zone_or_boundary_definition by either a Circular_runout_tolerance, a Circularity_tolerance, a Concentricity_and_coaxiality_tolerance, a Cylindricity_tolerance, a Flatness_tolerance, a Profile_of_any_surface_tolerance, a Symmetry_tolerance, or a Total_runout_tolerance.

4.2.742 Tolerance_zone_explicit_opposing_boundary_set

A Tolerance_zone_explicit_opposing_boundary_set is a type of Tolerance_zone_opposing_boundary_-set (see 4.2.745) in which the two opposing boundary members are explicitly identified.

The data associated with a Tolerance_zone_explicit_opposing_boundary_set are the following:

— boundary_members.

4.2.742.1 boundary_members

The boundary_members specify the Tolerance_zone_boundary_member (see 4.2.736) that comprise the Tolerance_zone_explicit_opposing_boundary_set. There shall be exactly two Tolerance_zone_boundary_members specified as boundary_members for a Tolerance_zone_explicit_opposing_boundary_set.

4.2.743 Tolerance_zone_form

A Tolerance_zone_form is a type of Managed_design_object (see 4.2.431). A Tolerance_zone_form is a definition that characterizes of the form of the Tolerance_zone (see 4.2.732).

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The data associated with a Tolerance_zone_form are the following:

— characterized_tolerance_zone;

— name;

— zone_definition.

4.2.743.1 characterized_tolerance_zone

The characterized_tolerance_zone specifies the Tolerance_zone (see 4.2.732) for which the Tolerance_zone_form is defined.

4.2.743.2 name

The name specifies the identifying label of the Tolerance_zone_form.

EXAMPLE 1 The name of the Tolerance_zone_form might be "cylindrical" for a Tolerance_zone that is defined by a Perpendicularity_tolerance.

4.2.743.3 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Tolerance_zone_form is dependent on the existence of the Tolerance_zone_definition (see 4.2.739) that specifies the Tolerance_zone_form as its form.

4.2.744 Tolerance_zone_implicit_opposing_boundary_set

A Tolerance_zone_implicit_opposing_boundary_set is a type of Tolerance_zone_opposing_boundary_set (see 4.2.745) in which the two opposing boundary members are not explicitly identified.

4.2.745 Tolerance_zone_opposing_boundary_set

A Tolerance_zone_opposing_boundary_set is a type of Tolerance_zone_boundary (see 4.2.734) that consists of a set of two like boundary members that are separated by a constant distance. A Tolerance_zone_opposing_boundary_set is either a Tolerance_zone_explicit_opposing_boundary_set (see 4.2.742) or a Tolerance_zone_implicit_opposing_boundary_set (see 4.2.744).

The data associated with a Tolerance_zone_opposing_boundary_set are the following:

— size_characteristic.

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4.2.745.1 size_characteristic

The size_characteristic is an inverse relationship that specifies that the existence of the Tolerance_zone_-opposing_boundary_set is dependent on the existence of the Opposing_boundary_set_size_characteristic (see 4.2.463) that specifies the Tolerance_zone_opposing_boundary_set as its sized_boundary_set.

EXAMPLE 1 Two opposing planes comprise the Tolerance_zone_boundary_set that is defined when a Flatness_tolerance (see 5.2.4.364) is applied to the top surface of a printed circuit board. The size_characteristic specifies the separation between the two opposing planes.

4.2.746 Tolerance_zone_per_unit_size_specification

A Tolerance_zone_per_unit_size_specification is a type of Managed_design_object (see 4.2.431). A Tolerance_zone_per_unit_size_specification is a specification of the Tolerance_zone_boundary (see 4.2.734) that defines the extent of the Tolerance_zone_boundary.

The data associated with a Tolerance_zone_per_unit_size_specification are the following:

— per_unit_size ;

— specified_tolerance_zone;

— zone_definition.

4.2.746.1 per_unit_size

The per_unit_size specifies the role of the Length_data_element (see 4.2.422) that represents the extent of the Tolerance_zone (see 4.2.732) for the Tolerance_zone_per_unit_size_specification. There may be one or two Length_data_elements specified as the per_unit_size for the Tolerance_zone_per_unit_size_-specification. If one Length_data_element is specified, it represents the linear extent of the Tolerance_-zone. If two Length_data_elements are specified, they represent the rectangular extent of the Tolerance_-zone.

4.2.746.2 specified_tolerance_zone

The specified_tolerance_zone specifies the Tolerance_zone (see 4.2.732) the extent of which is defined by the Tolerance_zone_per_unit_size_specification.

4.2.746.3 zone_definition

The zone_definition is an inverse relationship that specifies that the existence of the Tolerance_zone_-per_unit_size_specification is dependent on the existence of the Tolerance_zone_definition_with_per_-unit_size_specification (see 5.2.4.47) that specifies the Tolerance_zone_per_unit_size_specification as its per_unit_size_specification.

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4.2.747 Topological_junction

A Topological_junction is a type of Managed_design_object (see 4.2.431). A Topological_junction is used when at least three Component_terminal (see 4.2.105) are connected and the explicit topology must be stated.

The data associated with a Topological_junction are the following:

— name;

— scope.

4.2.747.1 name

The name identifies the Topological_junction.

4.2.747.2 scope

The scope specifies the role of the Physical_connectivity_structure_definition (see 5.2.4.147) for the Topological_junction.

Constraints:

UR1: The combination of the name and the scope shall be unique within a population of Topological_-junction.

4.2.748 Total_runout_tolerance

A Total_runout_tolerance is a type of Geometric_tolerance_with_referenced_datum_system (see 4.2.357) that specifies or partially specifies the design requirement on the run-out of a Physical_feature_or_part_-template (see 4.2.527) in relation to a Datum_axis (see 4.2.177) of a Datum_system (see 5.2.4.316). Where run-out is the quality or state of having perfect form and axial alignment in relation to an axis. A Total_runout_tolerance may either be applied normal to the surface or at a specified angle with respect to the Datum_axis. If the Total_runout_tolerance is applied at a specified angle the Tolerance_zone_-definition (see 4.2.739) is a Runout_tolerance_zone_definition_with_specified_angle (see 4.2.636). The Physical_feature_or_part_template may be either coaxial or normal to the Datum_axis.

NOTE Total run-out tolerance is defined in terms of tolerance zone definitions in 14.14 of ISO 1101.

Constraints:

WR1: The Shape_element specified as the toleranced_shape_element shall be a Physical_feature_or_-part_template.

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NOTE The attribute toleranced_shape_element is declared in the Geometric_tolerance entity of which this entity is a subtype.

WR2: The Total_runout_tolerance shall not be a Geometric_tolerance_with_applied_material_condition_property.

WR3: There shall be at most two Datum in the Datum_system the definition of which is specified by the datum_system_definition.

NOTE The attribute datum_system_definition is declared in the Geometric_tolerance_with_referenced_datum_system entity of which this entity is a subtype.

WR4: There shall be a Datum_axis in the Datum_system the definition of which is specified by the datum_system_definition.

WR5: The Datum_system_defining_conditions that is specified as the datum_system_definition shall be a Datum_system_defining_conditions_without_material_conditions.

WR6: The Total_runout_tolerance shall specify a Tolerance_zone_definition as its tolerance_zone_or_boundary_definition; and that Tolerance_zone_definition shall specify a Tolerance_zone_boundary_definition_with_specified_size as its boundary_definition; and that Tolerance_zone_boundary_definition_with_specified_size shall specify an Opposing_boundary_set_size_characteristic as its specified_boundary_size.

IP1: The form of the toleranced Physical_feature_or_part_template shall be consistent with the form of a physical feature for which the application of a total run-out tolerance is sensible.

4.2.749 Trace_template

A Trace_template is a type of Part_template (see 4.2.498) whose purpose is to define the width of a Conductive_interconnect_element (see 5.2.4.154) and the style of the ends and corners of that Conductive_interconnect_element. A Trace_template may be a Default_trace_template (see 5.2.4.99). A Trace_template shall not specify a curve_font on the Curve_style (see 5.2.4.253) specified by trace_style.

EXAMPLE 1 Figure 107 illustrates the cross-section view related to a Trace_template. The parameters included in the illustration are included in the Model_parameter (see 4.2.451) for the associated Analytical_model (see 4.2.10) and will be assigned specific values through Parameter_assignment (see 4.2.487) and associated Analytical_representation (see 4.2.16) application objects.

The data associated with a Trace_template are the following:

— trace_style.

4.2.749.1 trace_style

The trace_style specifies the role of the Curve_style for the Trace_template.

NOTE The Trace_template uses the parametric information in Curve_style, not the graphical presentation information.

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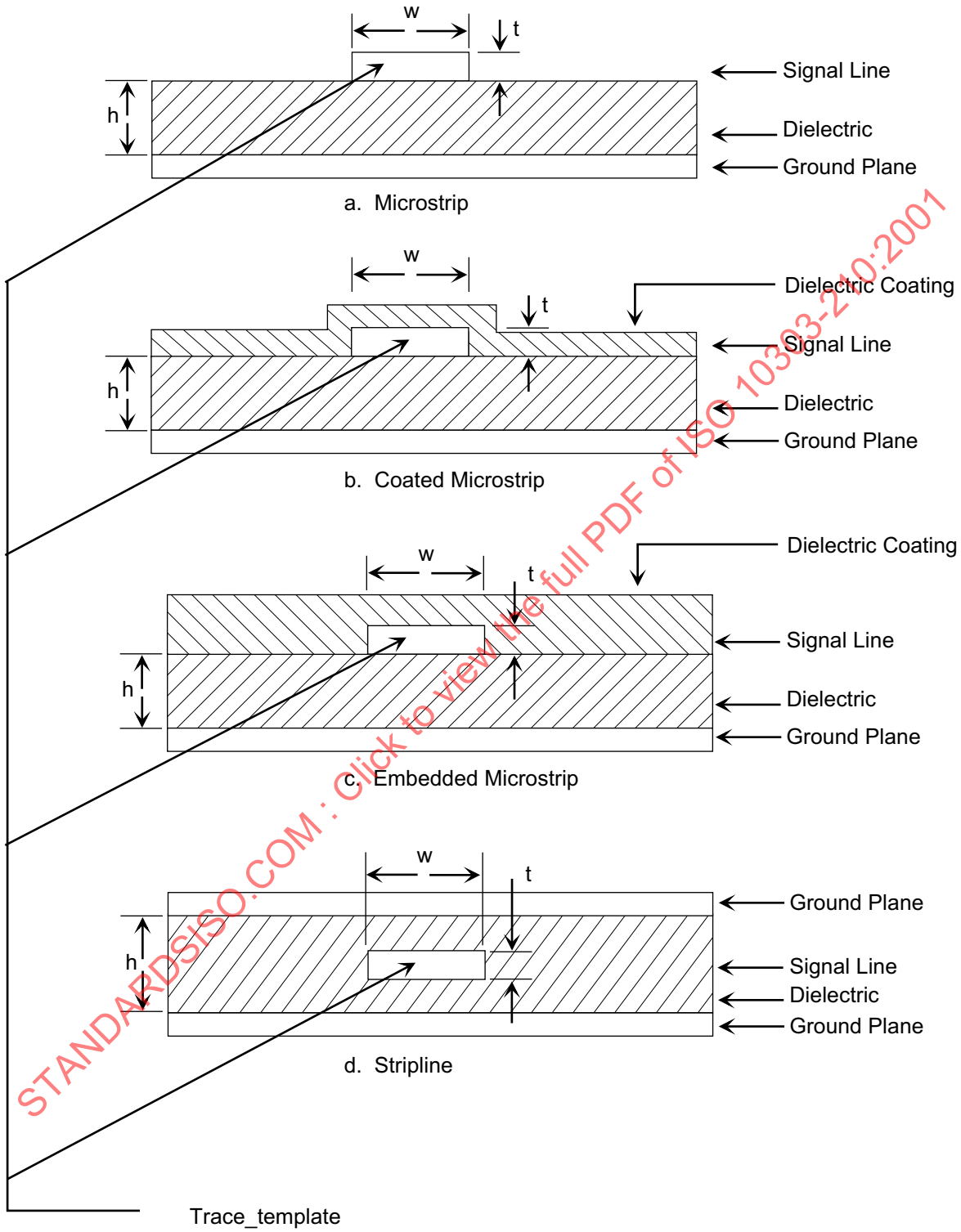

Figure 107 – Trace_template

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4.2.750 Transmission_line_functional_unit_terminal_allocation

A Transmission_line_functional_unit_terminal_allocation is a type of Managed_design_object (see 4.2.431). A Transmission_line_functional_unit_terminal_allocation is the relationship between the occurrence of a Functional_unit_terminal (see 5.2.4.267) of a transmission line and the physical implementation of that occurrence as a Printed_component_join_terminal (see 5.2.4.109).

The data associated with a Transmission_line_functional_unit_terminal_allocation are the following:

— functional_unit_design_path;

— implementation;

— transmission_line_functional_unit_terminal.

4.2.750.1 functional_unit_design_path

The functional_unit_design_path specifies the Transmission_line_functional_unit_to_routed_printed_component_allocation (see 5.2.4.369) path from the Functional_unit_terminal (see 5.2.4.267) to the Printed_component_join_terminal (see 5.2.4.109) for the Transmission_line_functional_unit_terminal_allocation.

4.2.750.2 implementation

The implementation specifies the role of the Printed_component_join_terminal (see 5.2.4.109) for the Transmission_line_functional_unit_terminal_allocation.

4.2.750.3 transmission_line_functional_unit_terminal

The transmission_line_functional_unit_terminal specifies the role of the Functional_unit_terminal (see 5.2.4.267) for this Transmission_line_functional_unit_terminal_allocation.

Constraints:

UR1: The combination of the implementation and transmission_line_functional_unit_terminal shall be unique within a population of Transmission_line_functional_unit_terminal_allocation.

4.2.751 Transmission_line_functional_unit_to_routed_printed_component_allocation

A Transmission_line_functional_unit_to_routed_printed_component_allocation is a type of Design_functional_unit_allocation_to_assembly_component (see 5.2.4.187). A transmission_line_functional_unit_to_routed_printed_component_allocation is the allocation of the functional requirements specified by a member of Functional_unit_definition (see 5.2.4.305) in a hierarchical definition to the Conductive_interconnect_element (see 5.2.4.154).

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The data associated with a Transmission_line_functional_unit_to_routed_printed_component_allocation are the following:

— implementation.

4.2.751.1 implementation

The implementation specifies the role of the Routed_printed_component (see 5.2.4.258) for the Transmission_line_functional_unit_to_routed_printed_component_allocation.

4.2.752 Trimmed_line

A Trimmed_line is a type of Curve (see 4.2.165) that has a defined, finite extent. The Trimmed_line shall be interpreted as a trimmed curve.

NOTE The Trimmed_line is necessary to support the specification of precise, metric geometry.

4.2.753 True_profile

A True_profile is a type of Managed_design_object (see 4.2.431). A True_profile is a definition that characterizes the theoretically exact shape of a Physical_feature_or_part_template (see 4.2.527).

The data associated with a True_profile are the following:

— boundary_definition;

— profile_representation;

— profiled_surface.

4.2.753.1 boundary_definition

The boundary_definition is an inverse relationship that specifies that the existence of the True_profile is dependent on the existence of the Profile_boundary_definition (see 4.2.591) that specifies the True_profile as its basic_profile. There shall be one or more Profile_boundary_definition for a True_profile.

4.2.753.2 profile_representation

The profile_representation specifies one of a Bound_volume_shape (see 4.2.58), a Dimension_set (see 5.2.4.121), an Ee_document (see 4.2.271), or an Ee_rule_function (see 5.2.4.90) that represents the True_profile.

4.2.753.3 profiled_surface

The profiled_surface specifies the Physical_feature_or_part_template (see 4.2.527) that is characterized by the True_profile

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4.2.754 Unsupported_passage

An Unsupported_passage is a type of Inter_stratum_feature (see 4.2.364) that has no metallization in the realization of its walls.

The data associated with an Unsupported_passage are the following:

— usage_definition.

4.2.754.1 usage_definition

The usage_definition specifies the role of the Unsupported_passage_template (see 4.2.756) for the Unsupported_passage.

Constraints:

WR1: An Unsupported_passage shall be an inner feature.

4.2.755 Unsupported_passage_dependent_non_functional_land

An Unsupported_passage_dependent_non_functional_land is a type of Non_functional_land (see 5.2.4.274) whose shape is dependent upon the shape of an Unsupported_passage.

The data associated with an Unsupported_passage_dependent_non_functional_land are the following:

— reference_passage;

— usage_definition.

4.2.755.1 reference_passage

The reference_passage specifies the role of the Unsupported_passage (see 5.2.4.2) for the Unsupported_passage_dependent_non_functional_land.

4.2.755.2 usage_definition

The usage_definition specifies the role of the Default_unsupported_passage_based_land_physical_template (see 5.2.4.97) for the Unsupported_passage_dependent_non_functional_land.

4.2.756 Unsupported_passage_template

An Unsupported_passage_template is a type of Inter_stratum_feature_template (see 5.2.4.76).

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NOTE The Unsupported_passage_template associates shape information with the passage_technology parametric property information. "Unsupported" carries the meaning that the passage is not mechanically or electrically supported by deposited sidewalls.

The data associated with an Unsupported_passage_template are the following:

— of_passage_technology.

4.2.756.1 of_passage_technology

The of_passage_technology specifies the role of the Default_unsupported_passage_definition (see 5.2.4.148) for the Unsupported_passage_template.

4.2.757 Usage_concept_usage_relationship

A Usage_concept_usage_relationship is a type of Managed_design_object (see 4.2.431). A Usage_concept_usage_relationship is the association between a Component_termination_passage_template_terminal (see 4.2.119), a Land_template_terminal (see 4.2.413), a Part_feature (see 4.2.494), a Part_template (see 4.2.498), a Physical_unit_usage_view (see 4.2.538), a Printed_part_template_terminal (see 4.2.586), or a Via_template_terminal (see 4.2.767), as a source and a Component_termination_passage_template_terminal, a Land_template_terminal, a Part_feature, a Part_template, a Physical_unit_usage_view, a Printed_part_template_terminal or a Via_template_terminal as a target. This relationship positions and orients the geometric model of the source into the model of the target using a transformation.

The data associated with an Usage_concept_usage_relationship are the following:

— associated_usage;

— associated_usage_placement;

— associating_usage.

4.2.757.1 associated_usage

The associated_usage specifies either a Component_termination_passage_template_terminal (see 4.2.119), a Land_template_terminal (see 4.2.413), a Part_feature (see 4.2.494), a Part_template (see 4.2.498), a Physical_unit_usage_view (see 4.2.538), a Printed_part_template_terminal (see 4.2.586), or a Via_template_terminal (see 4.2.767) as the target item for the Usage_concept_usage_relationship.

4.2.757.2 associated_usage_placement

The associated_usage_placement specifies the Axis_placement (see 4.2.43) of the target item in the coordinate system of the source item for the Usage_concept_usage_relationship, including any transformation required.

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4.2.757.3 associating_usage

The associating_usage specifies either a Component_termination_passage_template_terminal (see 4.2.119), a Land_template_terminal (see 4.2.413), a Part_feature (see 4.2.494), a Part_template (see 4.2.498), a Physical_unit_usage_view (see 4.2.538), a Printed_part_template_terminal (see 4.2.586), or a Via_template_terminal (see 4.2.767) as the source item for the Usage_concept_usage_relationship.

Constraints:

WR1: No member specified by associated_usage or by associating_usage shall be an ancestor or descendant of itself.

IP1: All necessary geometric model relationships to support this requirement shall be included.

4.2.758 User_defined_dimension_qualifier

A User_defined_dimension_qualifier is a type of Dimension_qualifier (see 5.2.4.183) that requires a more detailed description than those stated for a Pre_defined_dimension_qualifier (see 5.2.4.349).

The data associated with an User_defined_dimension_qualifier are the following:

— description;

— name.

4.2.758.1 description

The description specifies the text that describes the manner in which the Dimensional_characteristic (see 4.2.256) that are specified as the qualified_dimensions are qualified by the User_defined_dimension_qualifier.

NOTE The attribute qualified_dimensions is declared in the Dimension_qualifier entity of which this entity is a subtype.

4.2.758.2 name

The name specifies the label for the User_defined_dimension_qualifier by which it is referred.

4.2.759 User_defined_geometric_tolerance_qualifier

A User_defined_geometric_tolerance_qualifier is a type of Geometric_tolerance_qualifier (see 5.2.4.74) that requires a more detailed description than those stated for a Pre_defined_geometric_tolerance_qualifier (see 5.2.4.233).

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The data associated with an User_defined_geometric_tolerance_qualifier are the following:

— description;

— name.

4.2.759.1 description

The description specifies the text that describes the manner in which the Geometric_tolerance (see 5.2.4.386) that are specified as the qualified_geometric_tolerances are qualified by the User_defined_geometric_tolerance_qualifier.

NOTE The attribute qualified_geometric_tolerances is declared in the Geometric_tolerance_qualifier entity of which this entity is a subtype.

4.2.759.2 name

The name specifies the label for the User_defined_geometric_tolerance_qualifier by which it is referred.

4.2.760 Vector

A Vector is a type of Managed_design_object (see 4.2.431). A Vector is a quantity that has magnitude and direction and that is commonly represented by a directed line segment whose length represents the magnitude and whose orientation in space represents the direction.

4.2.761 Via

A Via is a type of Plated_passage (see 5.2.4.360). A Via is one of a Blind_via (see 4.2.53), a Buried_via (see 4.2.63), or an Interfacial_connection (see 5.2.4.219). Via is defined in IEC 60050-541.

EXAMPLE 1 Figure 108 illustrates a padstack that contains a Via.

The data associated with a Via are the following:

— usage_definition.

4.2.761.1 usage_definition

The usage_definition specifies the role of the Via_template (see 5.2.4.19) for the Via.

Constraints:

WR1: A Via shall not interface to an external device. This fact shall be represented by a value of the attribute feature_of_size on the supertype Inter_stratum_feature being set to "FALSE".

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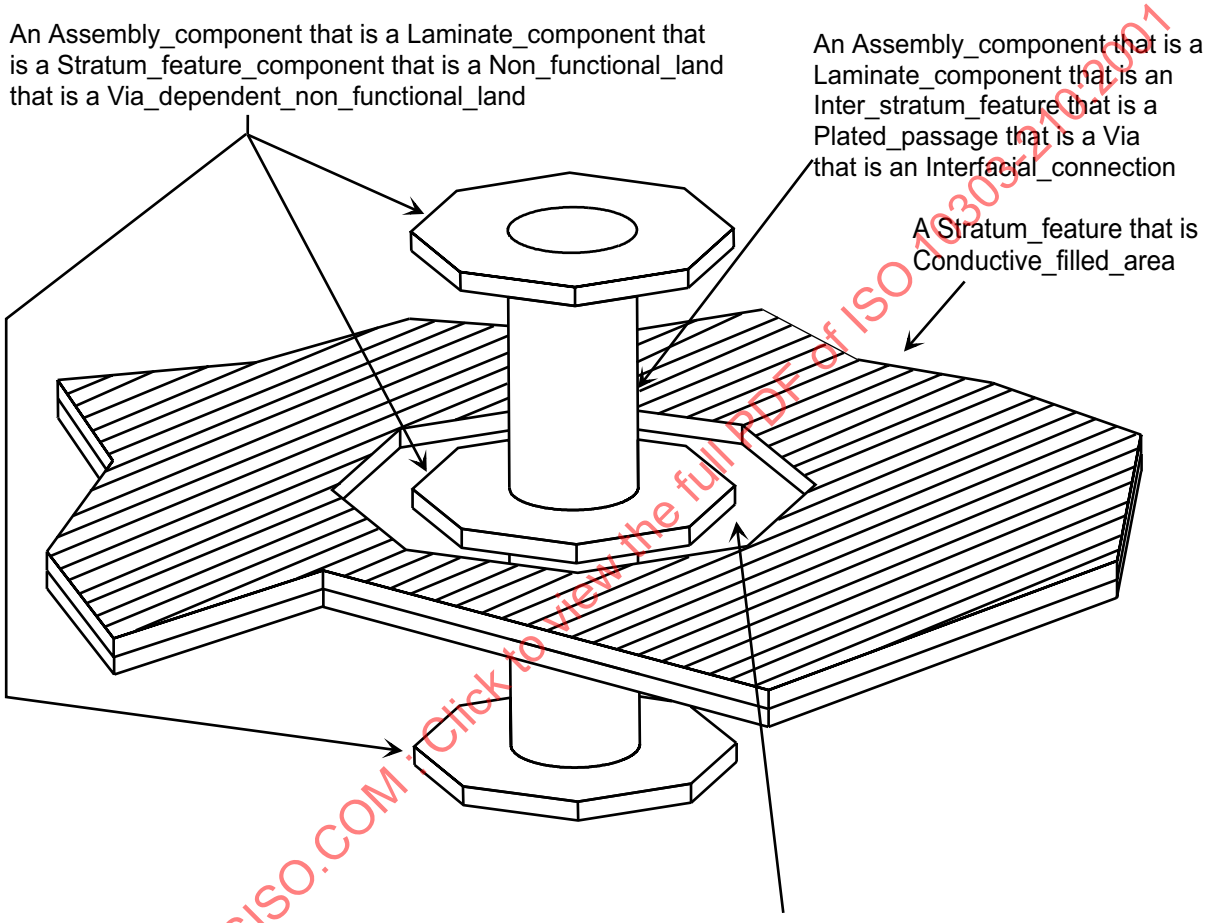

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Figure 108 – Via

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4.2.762 Via_and_contact_size_dependent_land

A Via_and_contact_size_dependent_land is a type of Land (see 4.2.407) whose shape is dependent upon a Via (see 4.2.761) as well as the size of a Component terminal (see 4.2.105).

The data associated with a Via_and_contact_size_dependent_land are the following:

— reference_via;

— usage_definition.

4.2.762.1 reference_via

The reference_via specifies the role of the Via (see 4.2.761) for the Via_and_contact_size_dependent_-land.

4.2.762.2 usage_definition

The usage_definition specifies the role of the Default_attachment_size_and_via_based_land_physical_-template (see 5.2.4.86) for the Via_and_contact_size_dependent_land.

4.2.763 Via_and_contact_size_dependent_non_functional_land

A Via_and_contact_size_dependent_non_functional_land is a type of Non_functional_land (see 5.2.4.274) whose shape is dependent on a Via (see 4.2.761) as well as the size of a Component terminal (see 4.2.105).

The data associated with a Via_and_contact_size_dependent_non_functional_land are the following:

— reference_via;

— usage_definition.

4.2.763.1 reference_via

The reference_via specifies the role of the Via (see 4.2.761) for the Via_and_contact_size_dependent_-non_functional_land.

4.2.763.2 usage_definition

The usage_definition specifies the role of the Default_via_based_land_physical_template (see 5.2.4.88) for the Via_and_contact_size_dependent_non_functional_land.

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4.2.764 Via_dependent_land

A Via_dependent_land is a type of Land (see 4.2.407) whose shape is dependent only on a Via (see 4.2.761).

The data associated with a Via_dependent_land are the following:

— reference_via;

— usage_definition.

4.2.764.1 reference_via

The reference_via specifies the role of the Via (see 4.2.761) for the Via_dependent_land.

4.2.764.2 usage_definition

The usage_definition specifies the role of the Default_via_based_land_physical_template (see 5.2.4.88) for the Via_dependent_land.

4.2.765 Via_dependent_non_functional_land

A Via_dependent_non_functional_land is a type of Non_functional_land (see 5.2.4.274) whose shape is dependent only on a Via (see 4.2.761).

The data associated with a Via_dependent_non_functional_land are the following:

— reference_via;

— usage_definition.

4.2.765.1 reference_via

The reference_via specifies the role of the Via (see 4.2.761) for the Via_dependent_non_functional_land.

4.2.765.2 usage_definition

The usage_definition specifies the role of the Default_via_based_land_physical_template (see 5.2.4.88) for the Via_dependent_non_functional_land.

4.2.766 Via_template

A Via_template is a type of Inter_stratum_feature_template (see 5.2.4.76).

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NOTE A Via_template provides a template for a plated passage that supports the realization of connectivity. The access_mechanisms attribute relates the Via_template to two or more terminals, thereby capturing complete connectivity information.

The data associated with a Via_template are the following:

— access_mechanisms;

— of_passage_technology.

4.2.766.1 access_mechanisms

The access_mechanisms is an inverse relationship that specifies that the existence of the Via_template is dependent on the existence of the Via_template_terminal (see 4.2.767) that specifies the Via_template as its associated_definition. There shall be two or more Via_template_terminals for a Via_template.

4.2.766.2 of_passage_technology

The of_passage_technology specifies the role of the Default_via_definition (see 5.2.4.89) for the Via_-template.

4.2.767 Via_template_terminal

A Via_template_terminal is a type of Managed_design_object (see 4.2.431). A Via_template_terminal is a terminal in a Via_template (see 5.2.4.19). A Via_template_terminal is a terminal that is congruent with the exterior surface of the cylinder of the Via (see 4.2.761), including material covered by joined members of Land (see 4.2.407). The fabrication join capability is optionally constrained by a set of Stratum (see 4.2.677).

The data associated with a Via_template_terminal are the following:

— associated_definition;

— disallowed_inter_stratum_extent;

— name;

— terminal_connection_zone.

EXAMPLE 1 Figure 109 illustrates an abstraction of the cylinder associated with a Via and the associated terminal. Because a Via is always an internal design object, there are no interface or join subtypes. A usage view is included that defines the terminal to be just the external wall of the Via.

4.2.767.1 associated_definition

The associated_definition specifies the role of the Via_template (see 5.2.4.19) for the Via_template_-terminal.

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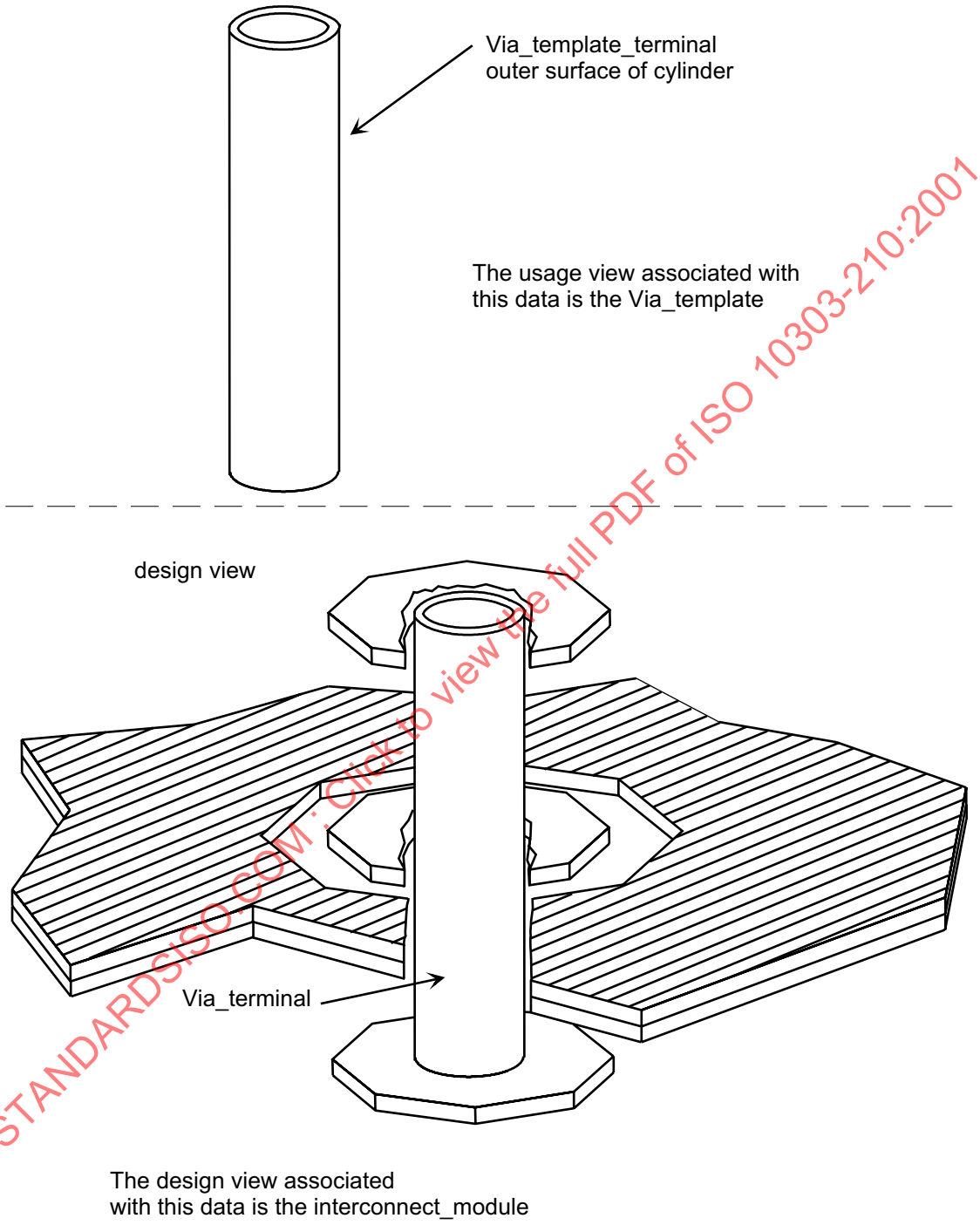

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Figure 109 – Via_template_terminal

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4.2.767.2 disallowed_inter_stratum_extent

The disallowed_inter_stratum_extent specifies the Inter_stratum_extent (see 5.2.4.83) for which a connection to the Via_template_terminal is disallowed. The disallowed_inter_stratum_extent need not be supplied for a Via_template_terminal. There may be more than one Inter_stratum_extent for a Via_template_terminal.

4.2.767.3 name

The name identifies the Via_template_terminal.

4.2.767.4 terminal_connection_zone

The terminal_connection_zone specifies the role of the Connection_zone (see 4.2.147) for the Via_template_terminal. There shall be one or more Connection_zone for the Via_template_terminal.

Constraints:

UR1: The combination of the name and associated_definition shall be unique within a population of Via_template_terminal.

4.2.768 Via_terminal

A Via_terminal is a type of Component_terminal (see 4.2.105). A Via_terminal is associated with the larger diameter wall of the Via that geometrically approximates a hollow cylinder with some thickness.

NOTE Since the Via itself is not allowed to interface to an item external to the interconnect, there is no concept of a join or interface terminal associated with a Via. The Via_terminal is collocated with and congruent with the entire external wall of the cylinder and may be fastened to as often as necessary.

The data associated with a Via_terminal are the following:

— associated_component;

— definition.

4.2.768.1 associated_component

The associated_component specifies the role of the Via (see 4.2.761) for the Via_terminal.

4.2.768.2 definition

The definition specifies the role of the Via_template_terminal (see 4.2.767) for the Via_terminal.

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4.2.769 Viewing_plane

A Viewing_plane is a type of Non_feature_shape_element (see 5.2.4.127) that is a plane to which a Tolerance_zone_boundary (see 4.2.734) is oriented.

The data associated with a Viewing_plane are the following:

— viewing_plane_specification.

4.2.769.1 viewing_plane_specification

A viewing_plane_specification is an inverse relationship that specifies that the existence of the Viewing_-plane is dependent on the existence of the Viewing_plane_definition (see 4.2.771) that specifies the Viewing_plane as its defined_viewing_plane.

4.2.770 Viewing_plane_based_orientation

A Viewing_plane_based_orientation is a type of Managed_design_object (see 4.2.431). A Viewing_-plane_based_orientation is a definition that characterizes the orientation of a Tolerance_zone (see 4.2.732) with respect to a Viewing_plane (see 4.2.769).

The data associated with a Viewing_plane_based_orientation are the following:

— orienting_relationship;

— viewing_plane_specification.

4.2.770.1 orienting_relationship

The orienting_relationship specifies the Tolerance_zone_and_viewing_plane_orienting_relationship (see 4.2.733) that associates the Tolerance_zone (see 4.2.732) with the Viewing_plane (see 4.2.769) with which it is oriented.

4.2.770.2 viewing_plane_specification

The viewing_plane_specification specifies a Viewing_plane_definition (see 4.2.771) that characterizes the Viewing_plane (see 4.2.769) with which the Tolerance_zone (see 4.2.732) is oriented.

Constraints:

WR1: The Viewing_plane_based_orientation shall be specified as the zone_orientation by exactly one Tolerance_zone_definition_with_specified_orientation.

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WR2: The Viewing_plane specified as the defined_viewing_plane by the Viewing_plane_definition that is specified as the viewing_plane_specification shall be the same instance of Viewing_plane as specified as the orienting_viewing_plane by the Tolerance_zone_and_viewing_plane_orienting_relationship that is specified as the orienting_relationship.

4.2.771 Viewing_plane_definition

A Viewing_plane_definition is a type of Managed_design_object (see 4.2.431). A Viewing_plane_definition is a definition that characterizes a Viewing_plane (see 4.2.769).

The data associated with a Viewing_plane_definition are the following:

— defined_viewing_plane;

— viewing_plane_representation;

— zone_orientation.

4.2.771.1 defined_viewing_plane

The defined_viewing_plane specifies the Viewing_plane (see 4.2.769) that is characterized by the Viewing_plane_definition, and with which the specified Tolerance_zone (see 4.2.732) is oriented.

4.2.771.2 viewing_plane_representation

The viewing_plane_representation specifies the Axis_placement (see 4.2.43) that characterizes the Viewing_plane (see 4.2.769) for the Viewing_plane_definition.

4.2.771.3 zone_orientation

The zone_orientation is an inverse relationship that specifies that the existence of the Viewing_plane_definition is dependent on the existence of the Viewing_plane_based_orientation (see 4.2.770) that specifies the Viewing_plane_definition as its viewing_plane_specification.

4.2.772 Volume_shape_projection

A Volume_shape_projection is a type of Managed_design_object (see 4.2.431). A Volume_shape_projection is the projection into two dimensions of a three-dimensional shape.

The data associated with a Volume_shape_projection are the following:

— orientation_seating_plane;

— projected_volume;

— surface_projection.

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4.2.772.1 orientation_seating_plane

The orientation_seating_plane specifies the role of the Axis_placement (see 4.2.43) for the Volume_-shape_projection. The Z axis of the Axis_placement shall be parallel to the normal of the plane.

4.2.772.2 projected_volume

The projected_volume specifies the role of the Bound_volume_shape (see 4.2.58) for the Volume_-shape_projection.

4.2.772.3 surface_projection

The surface_projection specifies the role of the Planar_projected_shape (see 5.2.4.45) for the Volume_-shape_projection.

4.2.773 Wire_terminal

A Wire_terminal is a type of a Package_terminal (see 4.2.472) whose core_material is inherently flexible and ready for installation to a Pca (see 4.2.510) without prior formal preparation by shape modification. The shape of the Wire_terminal is incompletely defined in the library.

NOTE The Feature_shape_occurrence (see 4.2.316) inherited by the terminal may be the same Feature_shape_-occurrence that is specified by the associated Connection_zone (see 4.2.147). In this case the whole terminal is the Connection_zone.

The data associated with a Wire_terminal are the following:

— internal_connection_zone;

— maximum_wire_terminal_length;

— minimum_wire_terminal_length.

4.2.773.1 internal_connection_zone

The internal_connection_zone specifies the role of a Connection_zone (see 4.2.147) for the Wire_termi-nal. There shall be one or more Connection_zone for the Wire_terminal.

4.2.773.2 maximum_wire_terminal_length

The maximum_wire_terminal_length specifies the Length_data_element (see 4.2.422) for the maximum length of the Wire_terminal.

4.2.773.3 minimum_wire_terminal_length

The minimum_wire_terminal_length specifies the Length_data_element (see 4.2.422) for the minimum length of the Wire_terminal.

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4.2.774 Work_order

A Work_order is a type of Managed_design_object (see 4.2.431). A Work_order is one of a Change_order (see 4.2.75) or a Start_order (see 4.2.670), and is a document that authorizes work in the development of an initial or modified design of a product. A Work_order is the result of the processing of one or more Work_request (see 4.2.775).

The data associated with a Work_order are the following:

— additional_data;

— analysis_data;

— authorizing_agreement;

— initiator;

— referenced_work_request;

— release_date;

— resulting_product;

— start_date;

— work_order_approval;

— work_order_id.

4.2.774.1 additional_data

The additional_data specifies the Ee_text (see 4.2.293) that provides additional pertinent information that was compiled during the development of the related set of Work_request (see 4.2.775) for the Work_order. The additional_data need not be specified for a particular Work_order.

4.2.774.2 analysis_data

The analysis_data specifies the Ee_text (see 4.2.293) for the result of an assessment performed to validate the design or modification in a related set of Work_requests for the Work_order. The analysis_data need not be specified for a particular Work_order.

4.2.774.3 authorizing_agreement

The authorizing_agreement specifies the role of the Contract (see 4.2.159) for the Work_order. The authorizing_agreement need not be provided for a Work_order.

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4.2.774.4 initiator

The initiator specifies either the Person_and_organization (see 5.2.4.275) or the Organization (see 5.2.4.135), that initiates the Work_order. There shall be one or more Person_and_organization or Organization for the Work_order.

4.2.774.5 referenced_work_request

The referenced_work_request specifies the Organization (see 5.2.4.135) that initiated this Work_order. There shall be one or more Organization (see 5.2.4.135) for a Work_order.

4.2.774.6 release_date

The release_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) upon which the Work_order is released.

4.2.774.7 resulting_product

The resulting_product specifies the Ee_product_version (see 4.2.282) of the objects that are the subject of the Work_order. There shall be one or more Ee_product_version for a Work_order.

4.2.774.8 start_date

The start_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) upon which the Work_order is begun.

4.2.774.9 work_order_approval

The work_order_approval specifies the Ee_approval (see 4.2.269) that applies to the Work_order.

4.2.774.10 work_order_id

The work_order_id specifies the identifier of the Work_order.

Constraints:

UR1: The work_order_id shall be unique within a population of Work_order.

WR1: The resulting_product and the referenced_work_request shall specify the same Ee_product_-version.

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4.2.775 Work_request

A Work_request is a type of Managed_design_object (see 4.2.431). A Work_request is either a Change_request (see 4.2.76) or a Start_request (see 4.2.671), a document that identifies the work to be done to initiate or redefine the design of a part.

The data associated with a Work_request are the following:

— description;

— implementation_order;

— initiator;

— reason;

— referenced_product;

— request_date;

— request_recipient;

— status;

— work_request_approval;

— work_request_id.

4.2.775.1 description

The description specifies the Ee_text (see 4.2.293) information of the work to be done to create or change the design of a product by a Work_request.

4.2.775.2 implementation_order

The implementation_order is an inverse relationship that specifies the Work_order (see 4.2.774) that specifies the Work_request as its referenced_work_request. There shall be no more than one Work_order for a Work_request.

4.2.775.3 initiator

The initiator specifies either the Person_and_organization (see 5.2.4.275) or the Organization that initiates the Work_request. There shall be one or more Person_and_organization or Organization (see 5.2.4.135) for a Work_request.

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4.2.775.4 reason

The reason specifies the Ee_text (see 4.2.293) or the Evaluated_characteristic (see 5.2.4.158) which is the purpose for generating the Work_request.

4.2.775.5 referenced_product

The referenced_product specifies the specific Ee_product_version (see 4.2.282) that shall be the subject of the Work_request. There shall be one or more Ee_product_version for the Work_request.

4.2.775.6 request_date

The request_date specifies either the Date (see 4.2.174) or the Date_and_time (see 4.2.175) when the Work_request was initiated.

4.2.775.7 request_recipient

The request_recipient specifies either the Person_and_organization (see 5.2.4.275) or the Organization (see 5.2.4.135) that will receive the Work_request and take whatever action is called out in it. There shall be one or more Person_and_organization or Organization for a Work_request.

4.2.775.8 status

The status specifies the text that describes the current level of completion of the Work_request.

EXAMPLE 1 Example values for the status of a Work_request may be proposed, in-work, issued, and hold.

4.2.775.9 work_request_approval

The work_request_approval specifies the Ee_approval (see 4.2.269) for the Work_request before it is to be acted upon.

4.2.775.10 work_request_id

The work_request_id specifies the Ee_text (see 4.2.293) identifier for the proposed work on a product's design.

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Constraints:

UR1: The work_request_id shall be unique in a population of Work_request.

IP1: The work_request_id shall be unique in a population of Work_request in an Organization.

IP2: Each member of Work_request shall have at least one member of Change_request or Start_request in the role of change_or_start_request.

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4.3 Application assertions

This subclause specifies the application assertions for the application protocol. Application assertions specify the relationships between 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 Add_design_object_management_relationship to Managed_design_object

Each Add_design_object_management_relationship has current_design_object defined by exactly one Managed_design_object. Each Managed_design_object defines current_design_object for zero, one, or more Add_design_object_management_relationship objects.

4.3.2 Adjacent_stratum_surface_definition to Stratum_surface

Each Adjacent_stratum_surface_definition has precedent_surface defined by exactly one Stratum_surface. Each Stratum_surface defines precedent_surface for zero, one, or more Adjacent_stratum_surface_definition objects.

Each Adjacent_stratum_surface_definition has subsequent_surface defined by exactly one Stratum_surface. Each Stratum_surface defines subsequent_surface for zero, one, or more Adjacent_stratum_surface_definition objects.

4.3.3 Aggregate_connectivity_requirement to Design_composition_path

Each Aggregate_connectivity_requirement has design_definition_path defined by exactly one Design_composition_path. Each Design_composition_path defines design_definition_path for zero, one, or more Aggregate_connectivity_requirement objects.

4.3.4 Aggregate_connectivity_requirement to Functional_unit_network_node_definition

Each Aggregate_connectivity_requirement has connectivity_requirement defined by one or more Functional_unit_network_node_definition objects. Each Functional_unit_network_node_definition defines connectivity_requirement for zero, one, or more Aggregate_connectivity_requirement objects.

4.3.5 Alternate_product to Ee_product

Each Alternate_product has defined_alternate_product defined by exactly one Ee_product. Each Ee_product defines defined_alternate_product for zero, one, or more Alternate_product objects.

4.3.6 Alternate_select_product to Contract

Each Alternate_select_product has authorizing_agreement defined by zero or one Contract. Each Contract defines authorizing_agreement for zero, one, or more Alternate_select_product objects.

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4.3.7 Alternate_select_product to Ee_product

Each Alternate_select_product has defined_alternate_product defined by one or more Ee_product objects. Each Ee_product defines defined_alternate_product for zero, one, or more Alternate_select_product objects.

Each Alternate_select_product has defining_base_product defined by exactly one Ee_product. Each Ee_product defines defining_base_product for zero, one, or more Alternate_select_product objects.

4.3.8 Analytical_model to Ee_document

Each Analytical_model has reference_document defined by exactly one Ee_document. Each Ee_document defines reference_document for zero, one, or more Analytical_model objects.

4.3.9 Analytical_model to Language_reference_manual

Each Analytical_model has representation_language defined by exactly one Language_reference_manual. Each Language_reference_manual defines representation_language for zero, one, or more Analytical_model objects.

4.3.10 Analytical_model to Model_parameter

Each Analytical_model has parameter defined by one or more Model_parameter objects. Each Model_parameter defines parameter for zero, one, or more Analytical_model objects.

4.3.11 Analytical_model_port to Analytical_model

Each Analytical_model_port has accessed_analytical_model defined by exactly one Analytical_model. Each Analytical_model has access_mechanism defined by one or more Analytical_model_port objects.

4.3.12 Analytical_model_port_assignment to Analytical_model_port

Each Analytical_model_port_assignment has assigned_analytical_model_port defined by exactly one Analytical_model_port. Each Analytical_model_port defines assigned_analytical_model_port for zero, one, or more Analytical_model_port_assignment objects.

4.3.13 Analytical_model_port_assignment to Scalar_terminal_definition

Each Analytical_model_port_assignment has assigned_functional_unit_terminal defined by exactly one Scalar_terminal_definition. Each Scalar_terminal_definition defines assigned_functional_unit_terminal for zero, one, or more Analytical_model_port_assignment objects.

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4.3.14 Analytical_model_vector_port_assignment to Analytical_model_vector_port

Each Analytical_model_vector_port_assignment has assigned_analytical_model_vector_port defined by exactly one Analytical_model_vector_port. Each Analytical_model_vector_port defines assigned_analytical_model_vector_port for zero, one, or more Analytical_model_vector_port_assignment objects.

4.3.15 Analytical_model_vector_port_assignment to Scalar_terminal_definition

Each Analytical_model_vector_port_assignment has assigned_functional_unit_terminals defined by two or more Scalar_terminal_definition objects. Each Scalar_terminal_definition defines assigned_functional_unit_terminals for zero, one, or more Analytical_model_vector_port_assignment objects.

4.3.16 Analytical_representation to Analytical_model

Each Analytical_representation has model_representation defined by exactly one Analytical_model. Each Analytical_model defines model_representation for zero, one, or more Analytical_representation objects.

4.3.17 Analytical_representation to Parameter_assignment

Each Analytical_representation has model_parameter_assignment defined by one or more Parameter_assignment objects. Each Parameter_assignment defines model_parameter_assignment for zero, one, or more Analytical_representation objects.

4.3.18 Angular_dimension_with_direction_vector to Axis_placement

Each Angular_dimension_with_direction_vector has measurement_orientation defined by zero or one Axis_placement. Each Axis_placement defines measurement_orientation for zero, one, or more Angular_dimension_with_direction_vector objects. This assertion is established through axis_placement_or_datum_based_vector_orientation_select.

4.3.19 Angular_dimension_with_direction_vector to Datum_based_vector_orientation

Each Angular_dimension_with_direction_vector has measurement_orientation defined by zero or one Datum_based_vector_orientation. Each Datum_based_vector_orientation defines measurement_orientation for zero, one, or more Angular_dimension_with_direction_vector objects. This assertion is established through axis_placement_or_datum_based_vector_orientation_select.

4.3.20 Altered_package to Package

Each Altered_package has package_to_be_prepared defined by exactly one Package. Each Package defines package_to_be_prepared for zero, one, or more altered_package objects.

4.3.21 Altered_package_terminal to Altered_package

Each Altered_package_terminal has associated_definition defined by exactly one Altered_package. Each Altered_package defines associated_definition for zero, one, or more Altered_package_terminal objects.

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4.3.22 altered_package_terminal to Package_terminal

Each altered_package_terminal has terminal_to_be_prepared defined by exactly one Package_terminal. Each Package_terminal defines terminal_to_be_prepared for zero, one, or more Altered_package_terminal objects.

4.3.23 Altered_packaged_part to Altered_package

Each Altered_packaged_part has used_package defined by exactly one Altered_package. Each Altered_package defines used_package for zero, one, or more Altered_packaged_part objects.

4.3.24 Altered_packaged_part to Packaged_part

Each Altered_packaged_part has base_packaged_part defined by exactly one Packaged_part. Each Packaged_part defines base_packaged_part for zero, one, or more Altered_packaged_part objects.

4.3.25 Assembled_with_bonding to Assembly_bond_definition

Each Assembled_with_bonding has default_bond_definition defined by exactly one Assembly_bond_definition. Each Assembly_bond_definition defines default_bond_definition for zero, one, or more Assembled_with_bonding objects.

4.3.26 Assembled_with_fasteners to Sub_assembly_relationship

Each Assembled_with_fasteners has sub_assembly defined by exactly one Sub_assembly_relationship. Each Sub_assembly_relationship defines sub_assembly for zero, one, or more Assembled_with_fasteners objects.

4.3.27 Assembly_alternate_product to Physical_unit_design_view

Each Assembly_alternate_product has basis_context defined by exactly one Physical_unit_design_view. Each Physical_unit_design_view defines basis_context for zero, one, or more Assembly_alternate_product objects.

4.3.28 Assembly_bond_definition to Analytical_Representation

Each Assembly_bond_definition has analytical_assembly_bond_representation defined by zero, one, or more Analytical_Representation.

4.3.29 Assembly_bond_definition to Ee_material

Each Assembly_bond_definition has bond_material defined by exactly one Ee_material. Each Ee_material defines bond_material for zero, one, or more Assembly_bond_definition objects.

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4.3.30 Assembly_bond_definition to External_definition

Each Assembly_bond_definition has bond_category defined by exactly one External_definition. Each External_definition defines bond_category for zero, one, or more Assembly_bond_definition objects.

4.3.31 Assembly_component to Part_Feature

Each Assembly_component has bonded_feature_1 defined by exactly one Part_Feature. Each Assembly_component has bonded_feature_2 defined by exactly one Part_Feature.

4.3.32 Assembly_component to Part_template

Each Assembly_component has usage_definition defined by zero or one Part_template. Each Part_template defines usage_definition for zero, one, or more Assembly_component objects. This assertion is established through physical_unit_or_part_template.

4.3.33 Assembly_component to Physical_unit

Each Assembly_component has usage_definition defined by zero or one Physical_unit. Each Physical_unit defines usage_definition for zero, one, or more Assembly_component objects. This assertion is established through physical_unit_or_part_template.

4.3.34 Assembly_component_2d_shape to Assembly_component

Each Assembly_component_2d_shape has shape_characterized_component defined by exactly one Assembly_component. Each Assembly_component has component_2d_shape defined by zero or one Assembly_component_2d_shape.

4.3.35 Assembly_component_3d_shape to Assembly_component

Each Assembly_component_3d_shape has shape_characterized_component defined by exactly one Assembly_component. Each Assembly_component has component_3d_shape defined by zero or one Assembly_component_3d_shape.

4.3.36 Assembly_composition_relationship to Assembly_component

Each Assembly_composition_relationship has component defined by exactly one Assembly_component. Each Assembly_component has assembly defined by one or more Assembly_composition_relationship objects.

4.3.37 Assembly_composition_relationship to Ee_material

Each Assembly_composition_relationship has assembly_bonding_agent defined by zero or more Ee_material objects. Each Ee_material defines assembly_bonding_agent for zero, one, or more Assembly_composition_relationship objects.

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4.3.38 Assembly_composition_relationship to Physical_unit_design_view

Each Assembly_composition_relationship has assembly defined by exactly one Physical_unit_design_-view. Each Physical_unit_design_view defines assembly for zero, one, or more Assembly_composition_relationship objects.

4.3.39 Assembly_composition_relationship to Security_classification

Each Assembly_composition_relationship has security_code defined by exactly one Security_classification. Each Security_classification defines security_code for zero, one, or more Assembly_composition_-relationship objects.

4.3.40 Assembly_joint to Assembly_module_component_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Assembly_module_component_terminal objects. Each Assembly_module_component_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.41 Assembly_joint to Bare_die_component_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Bare_die_component_terminal objects. Each Bare_die_component_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.42 Assembly_joint to Component_feature

Each Assembly_joint has assembly_features defined by zero, one, or two Component_feature objects. Each Component_feature defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.43 Assembly_joint to Interconnect_component_interface_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Interconnect_component_-interface_terminal objects. Each Interconnect_component_interface_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_-select.

4.3.44 Assembly_joint to Interconnect_component_join_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Interconnect_component_-join_terminal objects. Each Interconnect_component_join_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

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4.3.45 Assembly_joint to Interconnect_module_component_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Interconnect_module_component_terminal objects. Each Interconnect_module_component_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.46 Assembly_joint to Package_terminal_occurrence

Each Assembly_joint has assembly_features defined by zero, one, or two Package_terminal_occurrence objects. Each Package_terminal_occurrence defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.47 Assembly_joint to Packaged_component_join_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Packaged_component_join_terminal objects. Each Packaged_component_join_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.48 Assembly_joint to Packaged_connector_component_interface_terminal

Each Assembly_joint has assembly_features defined by zero, one, or two Packaged_connector_component_interface_terminal objects. Each Packaged_connector_component_interface_terminal defines assembly_features for zero, one, or more Assembly_joint objects. This assertion is established through assembled_feature_select.

4.3.49 Assembly_material_composition_relationship to Data_element

Each Assembly_material_composition_relationship has quantity defined by zero or one Data_element. Each Data_element defines quantity for zero, one, or more Assembly_material_composition_relationship objects.

4.3.50 Assembly_material_composition_relationship to Ee_material

Each Assembly_material_composition_relationship has component_material defined by exactly one Ee_material. Each Ee_material defines component_material for zero, one, or more Assembly_material_composition_relationship objects.

4.3.51 Assembly_material_composition_relationship to Physical_unit_design_view

Each Assembly_material_composition_relationship has assembly defined by exactly one Physical_unit_design_view. Each Physical_unit_design_view defines assembly for zero, one, or more Assembly_material_composition_relationship objects.

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4.3.52 Assembly_material_composition_relationship to Security_classification

Each Assembly_material_composition_relationship has security_code defined by exactly one Security_classification. Each Security_classification defines security_code for zero, one, or more Assembly_material_composition_relationship objects.

4.3.53 Assembly_module_component to Assembly_module_usage_view

Each Assembly_module_component has usage_definition defined by exactly one Assembly_module_usage_view. Each Assembly_module_usage_view defines usage_definition for zero, one, or more Assembly_module_component objects.

4.3.54 Assembly_module_component_terminal to Assembly_module_component

Each Assembly_module_component_terminal has associated_component defined by exactly one Assembly_module_component. Each Assembly_module_component has access_mechanisms defined by two or more Assembly_module_component_terminal objects.

4.3.55 Assembly_module_component_terminal to Assembly_module_terminal

Each Assembly_module_component_terminal has definition defined by exactly one Assembly_module_terminal. Each Assembly_module_terminal defines definition for zero, one, or more Assembly_module_component_terminal objects.

4.3.56 Assembly_module_terminal to Assembly_module_usage_view

Each Assembly_module_terminal has associated_definition defined by exactly one Assembly_module_usage_view. Each Assembly_module_usage_view has access_mechanisms defined by two or more Assembly_module_terminal objects.

4.3.57 Assembly_module_terminal to Connection_zone

Each Assembly_module_terminal has terminal_connection_zone defined by one or more Connection_zone objects. Each Connection_zone defines terminal_connection_zone for one, or more Assembly_module_terminal objects.

4.3.58 Assembly_module_terminal to Feature_shape_occurrence

Each Assembly_module_terminal has feature_shape defined by one or more Feature_shape_occurrence objects. Each Feature_shape_occurrence defines feature_shape for zero, one, or more Assembly_module_terminal objects.

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4.3.59 Assembly_module_usage_view to Datum_based_length_measure

Each Assembly_module_usage_view has maximum_negative_component_height defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines maximum_negative_component_height for zero, one, or more Assembly_module_usage_view objects.

Each Assembly_module_usage_view has maximum_positive_component_height defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines maximum_positive_component_height for zero, one, or more Assembly_module_usage_view objects.

4.3.60 Assembly_module_usage_view to Functional_unit_usage_view

Each Assembly_module_usage_view has implemented_function defined by exactly one Functional_unit_usage_view. Each Functional_unit_usage_view defines implemented_function for zero, one, or more Assembly_module_usage_view objects.

4.3.61 Assembly_requirement_allocation to Assembly_component

Each Assembly_requirement_allocation has assembly_assignment defined by zero or one Assembly_component. Each Assembly_component defines assembly_assignment for zero, one, or more Assembly_requirement_allocation objects. This assertion is established through component_or_feature.

4.3.62 Assembly_requirement_allocation to Component_feature

Each Assembly_requirement_allocation has assembly_assignment defined by zero or one Component_feature. Each Component_feature defines assembly_assignment for zero, one, or more Assembly_requirement_allocation objects. This assertion is established through component_or_feature.

4.3.63 Assembly_requirement_allocation to Ee_requirement_occurrence

Each Assembly_requirement_allocation has requirement defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines requirement for zero, one, or more Assembly_requirement_allocation objects.

4.3.64 Assembly_separation_requirement_allocation to Assembly_component

Each Assembly_separation_requirement_allocation has disjoint_assignment defined by zero or more Assembly_component objects. Each Assembly_component defines disjoint_assignment for zero, one, or more Assembly_separation_requirement_allocation objects. This assertion is established through component_or_feature.

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4.3.65 Assembly_separation_requirement_allocation to Component_feature

Each Assembly_separation_requirement_allocation has disjoint_assignment defined by zero or more Component_feature objects. Each Component_feature defines disjoint_assignment for zero, one, or more Assembly_separation_requirement_allocation objects. This assertion is established through component_or_feature.

4.3.66 Axis_placement to Cartesian_point

Each Axis_placement has translation defined by exactly one Cartesian_point. Each Cartesian_point defines translation for zero, one, or more Axis_placement objects.

4.3.67 Axis_placement to Orientation

Each Axis_placement has device_orientation defined by exactly one Orientation. Each Orientation defines device_orientation for zero, one, or more Axis_placement objects.

4.3.68 Bare_die to Axis_placement

Each Bare_die has seating_plane defined by exactly one Axis_placement.

4.3.69 Bare_die to Cartesian_point

Each Bare_die has least_material_condition_centroid_location defined by zero or one Cartesian_point. Each Bare_die has maximum_material_condition_centroid_location defined by zero or one Cartesian_point.

4.3.70 Bare_die to Feature_shape_occurrence

Each Bare_die has seating_plane defined by exactly one Feature_shape_occurrence. Each Feature_shape_occurrence defines seating_plane for zero, one, or more Bare_die objects.

4.3.71 Bare_die to Functional_unit_usage_view

Each Bare_die has implemented_function defined by exactly one Functional_unit_usage_view. Each Functional_unit_usage_view defines implemented_function for zero, one, or more Bare_die objects.

4.3.72 Bare_die to Length_data_element

Each Bare_die has maximum_height_above_seating_plane defined by zero or one Length_data_element.

4.3.73 Bare_die to Technology

Each Bare_die has unit_technology defined by exactly one Technology. Each Technology defines unit_technology for zero, one, or more Bare_die objects.

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4.3.74 Bare_die_component to Bare_die

Each Bare_die_component has usage_definition defined by exactly one Bare_die. Each Bare_die defines usage_definition for zero, one, or more Bare_die_component objects.

4.3.75 Bare_die_component_terminal to Bare_die_component

Each Bare_die_component_terminal has associated_component defined by exactly one Bare_die_component. Each Bare_die_component defines associated_component for zero, one, or more Bare_die_component_terminal objects.

4.3.76 Bare_die_component_terminal to Bare_die_terminal

Each Bare_die_component_terminal has definition defined by exactly one Bare_die_terminal. Each Bare_die_terminal defines definition for zero, one, or more Bare_die_component_terminal objects.

4.3.77 Bare_die_terminal to Connection_zone

Each Bare_die_terminal has external_connection_area defined by exactly one Connection_zone. Each Connection_zone defines external_connection_area for zero, one, or more Bare_die_terminal objects.

4.3.78 Bare_die_terminal to Ee_material

Each Bare_die_terminal has material defined by exactly one Ee_material. Each Ee_material defines material for zero, one, or more Bare_die_terminal objects.

4.3.79 Bevel_edge_feature_shape to Angle_data_element

Each Bevel_edge_feature_shape has maximum_bevel_angle defined by exactly one Angle_data_element. Each Angle_data_element defines maximum_bevel_angle for zero, one, or more Bevel_edge_feature_shape objects.

Each Bevel_edge_feature_shape has minimum_bevel_angle defined by exactly one Angle_data_element. Each Angle_data_element defines minimum_bevel_angle for zero, one, or more Bevel_edge_feature_shape objects.

4.3.80 Bevel_edge_feature_shape to Length_data_element

Each Bevel_edge_feature_shape has maximum_bevel_width defined by exactly one Length_data_element. Each Length_data_element defines maximum_bevel_width for zero, one, or more Bevel_edge_feature_shape objects.

Each Bevel_edge_feature_shape has minimum_bevel_width defined by exactly one Length_data_element. Each Length_data_element defines minimum_bevel_width for zero, one, or more Bevel_edge_feature_shape objects.

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4.3.81 Blind_passage_template to Shape_dimension_representation

Each Blind_passage_template has bottom_distance_from_datum_reference defined by exactly one Shape_dimension_representation. Each Shape_dimension_representation defines bottom_distance_from_datum_reference for zero, one, or more Blind_passage_template objects.

4.3.82 Blind_passage_template to Stratum_surface

Each Blind_passage_template has datum_reference defined by exactly one Stratum_surface. Each Stratum_surface defines datum_reference for zero, one, or more Blind_passage_template objects.

4.3.83 Bond_assembly_position to Assembled_with_bonding

Each Bond_assembly_position has bond defined by exactly one Assembled_with_bonding. Each Assembled_with_bonding has bond_assembly_position defined by zero or one Bond_assembly_position.

4.3.84 Bond_assembly_position to Axis_placement_3d

Each Bond_assembly_position has bond_definition_placement defined by exactly one Axis_placement_3d. Each Axis_placement_3d defines bond_definition_placement for zero, one, or more Bond_assembly_position objects.

4.3.85 Bond_assembly_position to Default_assembly_bond_shape

Each Bond_assembly_position has bond_model defined by exactly one Default_assembly_bond_shape. Each Default_assembly_bond_shape defines bond_model for zero, one, or more Bond_assembly_position objects.

4.3.86 Bond_assembly_position to Physical_unit_3d_shape

Each Bond_assembly_position has assembly_model defined by exactly one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines assembly_model for zero, one, or more Bond_assembly_position objects.

4.3.87 Bonded_conductive_base_blind_via to Stratum_feature_conductive_join

Each Bonded_conductive_base_blind_via has features_join defined by exactly one Stratum_feature_conductive_join. Each Stratum_feature_conductive_join has using_via defined by zero or one Bonded_conductive_base_blind_via.

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4.3.88 Boolean_csg_result to Boolean_csg_result

Each Boolean_csg_result has operand_1 defined by zero or one Boolean_csg_result. Each Boolean_csg_result defines operand_1 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

Each Boolean_csg_result has operand_2 defined by zero or one Boolean_csg_result. Each Boolean_csg_result defines operand_2 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

4.3.89 Boolean_csg_result to Bound_volume_shape

Each Boolean_csg_result has operand_1 defined by zero or one Bound_volume_shape. Each Bound_volume_shape defines operand_1 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

Each Boolean_csg_result has operand_2 defined by zero or one Bound_volume_shape. Each Bound_volume_shape defines operand_2 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

4.3.90 Boolean_csg_result to Csg_primitive

Each Boolean_csg_result has operand_1 defined by zero or one Csg_primitive. Each Csg_primitive defines operand_1 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

Each Boolean_csg_result has operand_2 defined by zero or one Csg_primitive. Each Csg_primitive defines operand_2 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

4.3.91 Boolean_csg_result to Csg_primitive_2d

Each Boolean_csg_result has operand_1 defined by zero or one Csg_primitive_2d. Each Csg_primitive_2d defines operand_1 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

Each Boolean_csg_result has operand_2 defined by zero or one Csg_primitive_2d. Each Csg_primitive_2d defines operand_2 for zero, one, or more Boolean_csg_result objects. This assertion is established through boolean_csg_operand.

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4.3.92 Boolean_styled_area_result to Boolean_styled_area_result

Each Boolean_styled_area_result has operand_1 defined by zero or one Boolean_styled_area_result. Each Boolean_styled_area_result defines operand_1 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

Each Boolean_styled_area_result has operand_2 defined by zero or one Boolean_styled_area_result. Each Boolean_styled_area_result defines operand_2 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

4.3.93 Boolean_styled_area_result to Fill_area_occurrence

Each Boolean_styled_area_result has operand_1 defined by zero or one Fill_area_occurrence. Each Fill_area_occurrence defines operand_1 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

Each Boolean_styled_area_result has operand_2 defined by zero or one Fill_area_occurrence. Each Fill_area_occurrence defines operand_2 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

4.3.94 Boolean_styled_area_result to Styled_curve_occurrence

Each Boolean_styled_area_result has operand_1 defined by zero or one Styled_curve_occurrence. Each Styled_curve_occurrence defines operand_1 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

Each Boolean_styled_area_result has operand_2 defined by zero or one Styled_curve_occurrence. Each Styled_curve_occurrence defines operand_2 for zero, one, or more Boolean_styled_area_result objects. This assertion is established through styled_area_representation.

4.3.95 Boundary_based_position_tolerance to Profile_of_any_surface_tolerance_with_referenced_datum_system

Each Boundary_based_position_tolerance has profile_control defined by zero or one Profile_of_any_surface_tolerance_with_referenced_datum_system. Each Profile_of_any_surface_tolerance_with_referenced_datum_system defines profile_control for zero, one, or more Boundary_based_position_tolerance objects.

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4.3.96 Boundary_size_characteristic to Length_data_element

Each Boundary_size_characteristic has maximum_tolerance_value defined by zero or one Length_data_element. Each Length_data_element defines maximum_tolerance_value for zero, one, or more Boundary_size_characteristic objects.

Each Boundary_size_characteristic has tolerance_value defined by exactly one Length_data_element. Each Length_data_element defines tolerance_value for zero, one, or more Boundary_size_characteristic objects.

4.3.97 Boundary_zone_definition_with_specified_size to Boundary_size_characteristic

Each Boundary_zone_definition_with_specified_size has specified_boundary_size defined by exactly one Boundary_size_characteristic. Each Boundary_size_characteristic has boundary_definition defined by exactly one Boundary_zone_definition_with_specified_size.

4.3.98 Bounding_curve to External_definition

Each Bounding_curve has mapping_function defined by exactly one External_definition. Each External_definition defines mapping_function for zero, one, or more Bounding_curve objects.

4.3.99 Bounding_curve to Trimmed_line

Each Bounding_curve has basis_curve defined by exactly one Trimmed_line. Each Trimmed_line defines basis_curve for zero, one, or more Bounding_curve objects.

4.3.100 Bus_element_relationship to Bus_structural_definition

Each Bus_element_relationship has bus_definition defined by exactly one Bus_structural_definition. Each Bus_structural_definition has composition defined by exactly one Bus_element_relationship.

Each Bus_element_relationship has element defined by zero or more Bus_structural_definition objects. Each Bus_structural_definition has composition defined by exactly one Bus_element_relationship. This assertion is established through bus_structural_definition_or_node.

4.3.101 Bus_element_relationship to Functional_unit_network_node_definition

Each Bus_element_relationship has element defined by zero or more Functional_unit_network_node_definition objects. Each Functional_unit_network_node_definition defines element for zero, one, or more Bus_element_relationship objects. This assertion is established through bus_structural_definition_or_node.

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4.3.102 Cartesian_coordinate_system to Angle_data_element

Each Cartesian_coordinate_system has angular_uncertainty defined by exactly one Angle_data_element. Each Angle_data_element defines angular_uncertainty for zero, one, or more Cartesian_coordinate_system objects.

4.3.103 Cartesian_coordinate_system to Length_data_element

Each Cartesian_coordinate_system has length_uncertainty defined by exactly one Length_data_element. Each Length_data_element defines length_uncertainty for zero, one, or more Cartesian_coordinate_system objects.

4.3.104 Cartesian_transformation_operator_2d to Cartesian_point

Each Cartesian_transformation_operator_2d has translation defined by exactly one Cartesian_point. Each Cartesian_point defines translation for zero, one, or more Cartesian_transformation_operator_2d objects.

4.3.105 Cartesian_transformation_operator_2d to Orientation

Each Cartesian_transformation_operator_2d has device_orientation defined by exactly one Orientation. Each Orientation defines device_orientation for zero, one, or more Cartesian_transformation_operator_2d objects.

4.3.106 Cartesian_transformation_operator_2d to Positive_ratio_measure

Each Cartesian_transformation_operator_2d has scale defined by exactly one Positive_ratio_measure. Each Positive_ratio_measure defines scale for zero, one, or more Cartesian_transformation_operator_2d objects.

4.3.107 Certification to Date

Each Certification has certification_date defined by zero or one Date. Each Date defines certification_date for zero, one, or more Certification objects. This assertion is established through date_or_date_and_time.

4.3.108 Certification to Date_and_time

Each Certification has certification_date defined by zero or one Date_and_time. Each Date_and_time defines certification_date for zero, one, or more Certification objects. This assertion is established through date_or_date_and_time.

4.3.109 Certification to Ee_approval

Each Certification has certification_approval defined by exactly one Ee_approval. Each Ee_approval defines certification_approval for zero, one, or more Certification objects.

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4.3.110 Certification to Ee_text

Each Certification has certification_number defined by exactly one Ee_text. Each Ee_text defines certification_number for zero, one, or more Certification objects.

4.3.111 Certification to Supplied_product_version

Each Certification has certified_product_version defined by exactly one Supplied_product_version. Each Supplied_product_version has required_certification defined by zero or one Certification.

4.3.112 Change_design_object_management_relationship to Managed_design_object

Each Change_design_object_management_relationship has current_design_object defined by exactly one Managed_design_object. Each Managed_design_object defines current_design_object for zero, one, or more Change_design_object_management_relationship objects.

Each Change_design_object_management_relationship has previous_design_object defined by exactly one Managed_design_object. Each Managed_design_object defines previous_design_object for zero, one, or more Change_design_object_management_relationship objects.

4.3.113 Change_order to Design_object_management_relationship

Each Change_order has adopted_solution defined by zero or one Design_object_management_relationship. Each Design_object_management_relationship defines adopted_solution for zero, one, or more Change_order objects. This assertion is established through design_object_management_relationship_or_description.

4.3.114 Change_order to Ee_text

Each Change_order has adopted_solution defined by zero or one Ee_text. Each Ee_text defines adopted_solution for zero, one, or more Change_order objects. This assertion is established through design_object_management_relationship_or_description.

4.3.115 Change_request to Design_object_management_relationship

Each Change_request has recommended_solution defined by zero or more Design_object_management_relationship objects. Each Design_object_management_relationship defines recommended_solution for zero, one, or more Change_request objects. This assertion is established through design_object_management_relationship_or_description.

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4.3.116 Change_request to Ee_text

Each Change_request has consequence defined by one or more Ee_text objects. Each Ee_text defines consequence for zero, one, or more Change_request objects.

Each Change_request has recommended_solution defined by zero or more Ee_text objects. Each Ee_text defines recommended_solution for zero, one, or more Change_request objects. This assertion is established through design_object_management_relationship_or_description.

4.3.117 Characteristic to Data_element

Each Characteristic has property_value defined by zero or one Data_element. Each Data_element defines property_value for zero, one, or more Characteristic objects. This assertion is established through numeric_or_non_numeric_select.

4.3.118 Characteristic to Ee_document

Each Characteristic has reference_document defined by zero or one Ee_document. Each Ee_document defines reference_document for zero, one, or more Characteristic objects. This assertion is established through standard_or_reference_document.

4.3.119 Characteristic to External_definition

Each Characteristic has property_value defined by zero or one External_definition. Each External_definition defines property_value for zero, one, or more Characteristic objects. This assertion is established through numeric_or_non_numeric_select.

4.3.120 Component_2d_edge_location to Assembly_joint

Each Component_2d_edge_location has reference_terminal_assembly_joint defined by exactly one Assembly_joint. Each Assembly_joint defines reference_terminal_assembly_joint for zero, one, or more Component_2d_edge_location objects.

4.3.121 Component_2d_location to Cartesian_transformation_operator_2d

Each Component_2d_location has transformation defined by exactly one Cartesian_transformation_operator_2d. Each Cartesian_transformation_operator_2d defines transformation for zero, one, or more Component_2d_location objects.

4.3.122 Component_2d_location to Interconnect_module_component_surface_feature

Each Component_2d_location has mounting_surface defined by zero or one Interconnect_module_component_surface_feature. Each Interconnect_module_component_surface_feature defines mounting_surface for zero, one, or more Component_2d_location objects.

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4.3.123 Component_3d_location to Axis_placement_3d

Each Component_3d_location has transformation defined by exactly one Axis_placement_3d. Each Axis_placement_3d defines transformation for zero, one, or more Component_3d_location objects.

4.3.124 Component_assembly_2d_position to Assembly_component_2d_shape

Each Component_assembly_2d_position has component_model defined by exactly one Assembly_component_2d_shape. Each Assembly_component_2d_shape defines component_model for zero, one, or more Component_assembly_2d_position objects.

4.3.125 Component_assembly_2d_position to Component_2d_location

Each Component_assembly_2d_position has transformation defined by exactly one Component_2d_location. Each Component_2d_location defines transformation for zero, one, or more Component_assembly_2d_position objects.

4.3.126 Component_assembly_2d_position to Next_higher_assembly_relationship

Each Component_assembly_2d_position has component defined by exactly one Next_higher_assembly_relationship. Each Next_higher_assembly_relationship has assembly_position_2d defined by zero or one Component_assembly_2d_position.

4.3.127 Component_assembly_2d_position to Physical_unit_planar_shape

Each Component_assembly_2d_position has assembly_model defined by exactly one Physical_unit_planar_shape. Each Physical_unit_planar_shape defines assembly_model for zero, one, or more Component_assembly_2d_position objects.

4.3.128 Component_assembly_3d_position to Assembly_component_3d_shape

Each Component_assembly_3d_position has component_model defined by exactly one Assembly_component_3d_shape. Each Assembly_component_3d_shape defines component_model for zero, one, or more Component_assembly_3d_position objects.

4.3.129 Component_assembly_3d_position to Component_3d_location

Each Component_assembly_3d_position has transformation defined by exactly one Component_3d_location. Each Component_3d_location defines transformation for zero, one, or more Component_assembly_3d_position objects.

4.3.130 Component_assembly_3d_position to Next_higher_assembly_relationship

Each Component_assembly_3d_position has component defined by exactly one Next_higher_assembly_relationship. Each Next_higher_assembly_relationship has assembly_position_3d defined by zero or one Component_assembly_3d_position.

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4.3.131 Component_assembly_3d_position to Physical_unit_3d_shape

Each Component_assembly_3d_position has assembly_model defined by exactly one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines assembly_model for zero, one, or more Component_assembly_3d_position objects.

4.3.132 Component_based_annotation_symbol_placement_relationship to Special_symbol_laminate_component

Each Component_based_annotation_symbol_placement_relationship has related_stratum_concept defined by exactly one Special_symbol_laminate_component. Each Special_symbol_laminate_component defines related_stratum_concept for zero, one, or more Component_based_annotation_symbol_placement_relationship objects.

4.3.133 Component_based_annotation_text_relationship to Laminate_text_component

Each Component_based_annotation_text_relationship has related_stratum_concept defined by exactly one Laminate_text_component. Each Laminate_text_component defines related_stratum_concept for zero, one, or more Component_based_annotation_text_relationship objects.

4.3.134 Component_feature to Assembly_component

Each Component_feature has associated_component defined by exactly one Assembly_component. Each Assembly_component defines associated_component for zero, one, or more Component_feature objects.

4.3.135 Component_feature to Component_termination_passage_template_terminal

Each Component_feature has definition defined by zero or one Component_termination_passage_template_terminal. Each Component_termination_passage_template_terminal defines definition for zero, one, or more Component_feature objects. This assertion is established through part_feature_or_template_feature.

4.3.136 Component_feature to Land_template_terminal

Each Component_feature has definition defined by zero or one Land_template_terminal. Each Land_template_terminal defines definition for zero, one, or more Component_feature objects. This assertion is established through part_feature_or_template_feature.

4.3.137 Component_feature to Part_feature

Each Component_feature has definition defined by zero or one Part_feature. Each Part_feature defines definition for zero, one, or more Component_feature objects. This assertion is established through part_feature_or_template_feature.

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4.3.138 Component_feature to Printed_part_template_terminal

Each Component_feature has definition defined by zero or one Printed_part_template_terminal. Each Printed_part_template_terminal defines definition for zero, one, or more Component_feature objects. This assertion is established through part_feature_or_template_feature.

4.3.139 Component_feature to Via_template_terminal

Each Component_feature has definition defined by zero or one Via_template_terminal. Each Via_template_terminal defines definition for zero, one, or more Component_feature objects. This assertion is established through part_feature_or_template_feature.

4.3.140 Component_feature_external_reference to Component_external_reference

Each Component_feature_external_reference has definition defined by exactly one Component_external_reference.

4.3.141 Component_feature_make_from_relationship to Component_feature

Each Component_feature_make_from_relationship has resultant_feature defined by exactly one Component_feature. Each Component_feature defines resultant_feature for zero, one, or more Component_feature_make_from_relationship objects.

Each Component_feature_make_from_relationship has reusable_feature defined by exactly one Component_feature. Each Component_feature defines reusable_feature for zero, one, or more Component_feature_make_from_relationship objects.

4.3.142 Component_feature_relationship to Component_feature

Each Component_feature_relationship has related_component_feature defined by exactly one Component_feature. Each Component_feature defines related_component_feature for zero, one, or more Component_feature_relationship objects.

Each Component_feature_relationship has relating_component_feature defined by exactly one Component_feature. Each Component_feature defines relating_component_feature for zero, one, or more Component_feature_relationship objects.

4.3.143 Component_feature_to_layout_feature_relationship to Assembly_component

Each Component_feature_to_layout_feature_relationship has relating_feature defined by zero or one Assembly_component. Each Assembly_component defines relating_feature for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through component_or_component_feature.

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4.3.144 Component_feature_to_layout_feature_relationship to Component_feature

Each Component_feature_to_layout_feature_relationship has relating_feature defined by zero or one Component_feature. Each Component_feature defines relating_feature for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through component_or_component_feature.

4.3.145 Component_feature_to_layout_feature_relationship to Ee_requirement_occurrence

Each Component_feature_to_layout_feature_relationship has requirement defined by zero or one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines requirement for zero, one, or more Component_feature_to_layout_feature_relationship objects.

4.3.146 Component_feature_to_layout_feature_relationship to Inter_stratum_feature

Each Component_feature_to_layout_feature_relationship has related_stratum_concept defined by zero or one Inter_stratum_feature. Each Inter_stratum_feature defines related_stratum_concept for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through stratum_concept.

4.3.147 Component_feature_to_layout_feature_relationship to Laminate_component

Each Component_feature_to_layout_feature_relationship has related_stratum_concept defined by zero or one Laminate_component. Each Laminate_component defines related_stratum_concept for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through stratum_concept.

4.3.148 Component_feature_to_layout_feature_relationship to Stratum

Each Component_feature_to_layout_feature_relationship has related_stratum_concept defined by zero or one Stratum. Each Stratum defines related_stratum_concept for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through stratum_concept.

4.3.149 Component_feature_to_layout_feature_relationship to Stratum_feature

Each Component_feature_to_layout_feature_relationship has related_stratum_concept defined by zero or one Stratum_feature. Each Stratum_feature defines related_stratum_concept for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through stratum_concept.

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4.3.150 Component_feature_to_layout_feature_relationship to Stratum_surface

Each Component_feature_to_layout_feature_relationship has related_stratum_concept defined by zero or one Stratum_surface. Each Stratum_surface defines related_stratum_concept for zero, one, or more Component_feature_to_layout_feature_relationship objects. This assertion is established through stratum_concept.

4.3.151 Component_feature_to_physical_usage_view_assignment to Component_feature

Each Component_feature_to_physical_usage_view_assignment has assigned_design_object defined by exactly one Component_feature. Each Component_feature has defined_product_feature defined by zero or one Component_feature_to_physical_usage_view_assignment.

4.3.152 Component_feature_to_physical_usage_view_assignment to Part_feature

Each Component_feature_to_physical_usage_view_assignment has defined_part_feature defined by exactly one Part_feature. Each Part_feature has design_view_definition_component_feature defined by zero or one Component_feature_to_physical_usage_view_assignment.

4.3.153 Component_group_assignment to Assembly_component

Each Component_group_assignment has assigned_component defined by exactly one Assembly_component. Each Assembly_component defines assigned_component for zero, one, or more Component_group_assignment objects.

4.3.154 Component_group_assignment to Placement_group

Each Component_group_assignment has associated_group defined by exactly one Placement_group. Each Placement_group defines associated_group for zero, one, or more Component_group_assignment objects.

4.3.155 Component_interface_terminal to Interface_component

Each Component_interface_terminal has associated_component defined by exactly one Interface_component. Each Interface_component has access_mechanism defined by one or more Component_interface_terminal objects.

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4.3.156 Component_make_from_relationship to Assembly_composition_relationship

Each Component_make_from_relationship has resultant_component defined by exactly one Assembly_composition_relationship. Each Assembly_composition_relationship defines resultant_component for zero, one, or more Component_make_from_relationship objects.

Each Component_make_from_relationship has reusable_component defined by exactly one Assembly_composition_relationship. Each Assembly_composition_relationship defines reusable_component for zero, one, or more Component_make_from_relationship objects.

4.3.157 Component_mounting_clearance_relationship to Length_data_element

Each Component_mounting_clearance_relationship has maximum_mounting_clearance defined by zero or one Length_data_element. Each Length_data_element defines maximum_mounting_clearance for zero, one, or more Component_mounting_clearance_relationship objects.

Each Component_mounting_clearance_relationship has minimum_mounting_clearance defined by exactly one Length_data_element. Each Length_data_element defines minimum_mounting_clearance for zero, one, or more Component_mounting_clearance_relationship objects.

4.3.158 Component_mounting_clearance_relationship to Next_higher_assembly_relationship

Each Component_mounting_clearance_relationship has current_component defined by exactly one Next_higher_assembly_relationship. Each Next_higher_assembly_relationship defines current_component for zero, one, or more Component_mounting_clearance_relationship objects.

Each Component_mounting_clearance_relationship has previously_placed_component defined by exactly one Next_higher_assembly_relationship. Each Next_higher_assembly_relationship defines previously_placed_component for zero, one, or more Component_mounting_clearance_relationship objects.

4.3.159 Component_overlap_relationship to Length_data_element

Each Component_overlap_relationship has maximum_added_clearance defined by zero or one Length_data_element. Each Length_data_element defines maximum_added_clearance for zero, one, or more Component_overlap_relationship objects.

Each Component_overlap_relationship has minimum_added_clearance defined by exactly one Length_data_element. Each Length_data_element defines minimum_added_clearance for zero, one, or more Component_overlap_relationship objects.

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4.3.160 Component_overlap_relationship to Next_higher_assembly_relationship

Each Component_overlap_relationship has current_component defined by exactly one Next_higher_-assembly_relationship. Each Next_higher_assembly_relationship defines current_component for zero, one, or more Component_overlap_relationship objects.

Each Component_overlap_relationship has previously_placed_component defined by exactly one Next_-higher_assembly_relationship. Each Next_higher_assembly_relationship defines previously_placed_-component for zero, one, or more Component_overlap_relationship objects.

4.3.161 Component_part_2d_geometric_representation_relationship to Assembly_component_2d_shape

Each Component_part_2d_geometric_representation_relationship has component_shape defined by exactly one Assembly_component_2d_shape. Each Assembly_component_2d_shape defines component_-shape for zero, one, or more Component_part_2d_geometric_representation_relationship objects.

4.3.162 Component_part_2d_geometric_representation_relationship to Part_template_planar_shape

Each Component_part_2d_geometric_representation_relationship has part_shape defined by zero or one Part_template_planar_shape. Each Part_template_planar_shape defines part_shape for zero, one, or more Component_part_2d_geometric_representation_relationship objects. This assertion is established through part_template_or_physical_unit_2d_shape_select.

4.3.163 Component_part_2d_geometric_representation_relationship to Physical_unit_planar_shape

Each Component_part_2d_geometric_representation_relationship has part_shape defined by zero or one Physical_unit_planar_shape. Each Physical_unit_planar_shape defines part_shape for zero, one, or more Component_part_2d_geometric_representation_relationship objects. This assertion is established through part_template_or_physical_unit_2d_shape_select.

4.3.164 Component_part_3d_geometric_representation_relationship to Assembly_component_3d_shape

Each Component_part_3d_geometric_representation_relationship has component_shape defined by exactly one Assembly_component_3d_shape. Each Assembly_component_3d_shape defines component_-shape for zero, one, or more Component_part_3d_geometric_representation_relationship objects.

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4.3.165 Component_part_3d_geometric_representation_relationship to Part_template_3d_shape

Each Component_part_3d_geometric_representation_relationship has part_shape defined by zero or one Part_template_3d_shape. Each Part_template_3d_shape defines part_shape for zero, one, or more Component_part_3d_geometric_representation_relationship objects. This assertion is established through part_template_or_physical_unit_3d_shape_select.

4.3.166 Component_part_2d_geometric_representation_relationship to Part_template_2d_shape

Each Component_part_2d_geometric_representation_relationship has part_shape defined by zero or one Part_template_2d_shape. Each Part_template_2d_shape defines part_shape for zero, one, or more Component_part_2d_geometric_representation_relationship objects. This assertion is established through part_template_or_physical_unit_2d_shape_select.

4.3.167 Component_part_3d_geometric_representation_relationship to Physical_unit_3d_shape

Each Component_part_3d_geometric_representation_relationship has part_shape defined by zero or one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines part_shape for zero, one, or more Component_part_3d_geometric_representation_relationship objects. This assertion is established through part_template_or_physical_unit_3d_shape_select.

4.3.168 Component_placement_restriction_assignment to Datum_based_length_measure

Each Component_placement_restriction_assignment has maximum_mounting_clearance defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines maximum_mounting_clearance for zero, one, or more Component_placement_restriction_assignment objects.

Each Component_placement_restriction_assignment has maximum_negative_component_height defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines maximum_negative_component_height for zero, one, or more Component_placement_restriction_assignment objects.

Each Component_placement_restriction_assignment has maximum_positive_component_height defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines maximum_positive_component_height for zero, one, or more Component_placement_restriction_assignment objects.

Each Component_placement_restriction_assignment has minimum_mounting_clearance defined by zero or one Datum_based_length_measure. Each Datum_based_length_measure defines minimum_mounting_clearance for zero, one, or more Component_placement_restriction_assignment objects.

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4.3.169 Component_placement_restriction_assignment to Item_restricted_requirement_occurrence

Each Component_placement_restriction_assignment has requirement defined by exactly one Item_restricted_requirement_occurrence. Each Item_restricted_requirement_occurrence defines requirement for zero, one, or more Component_placement_restriction_assignment objects.

4.3.170 Component_placement_restriction_assignment to Mounting_restriction_area

Each Component_placement_restriction_assignment has area defined by exactly one Mounting_restriction_area. Each Mounting_restriction_area defines area for zero, one, or more Component_placement_restriction_assignment objects.

4.3.171 Component_swap_specification to Design_functional_unit_allocation_to_assembly_component

Each Component_swap_specification has current_design_object defined by exactly one Design_functional_unit_allocation_to_assembly_component. Each Design_functional_unit_allocation_to_assembly_component defines current_design_object for zero, one, or more Component_swap_specification objects.

Each Component_swap_specification has previous_design_object defined by exactly one Design_functional_unit_allocation_to_assembly_component. Each Design_functional_unit_allocation_to_assembly_component defines previous_design_object for zero, one, or more Component_swap_specification objects.

4.3.172 Component_terminal_to_assembly_module_terminal_assignment to Assembly_module_component_terminal

Each Component_terminal_to_assembly_module_terminal_assignment has assigned_terminal defined by zero or one Assembly_module_component_terminal. Each Assembly_module_component_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_assembly_module_terminal_assignment objects. This assertion is established through Pca_interface_select.

4.3.173 Component_terminal_to_assembly_module_terminal_assignment to Assembly_module_terminal

Each Component_terminal_to_assembly_module_terminal_assignment has usage_view_terminal defined by exactly one Assembly_module_terminal. Each Assembly_module_terminal defines usage_view_terminal for zero, one, or more Component_terminal_to_assembly_module_terminal_assignment objects.

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4.3.174 Component_terminal_to_assembly_module_terminal_assignment to Component_interface_terminal

Each Component_terminal_to_assembly_module_terminal_assignment has assigned_terminal defined by zero or one Component_interface_terminal. Each Component_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_assembly_module_terminal_assignment objects. This assertion is established through Pca_interface_select.

4.3.175 Component_terminal_to_assembly_module_terminal_assignment to Interconnect_module_component_terminal

Each Component_terminal_to_assembly_module_terminal_assignment has assigned_terminal defined by zero or one Interconnect_module_component_terminal. Each Interconnect_module_component_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_assembly_module_terminal_assignment objects. This assertion is established through Pca_interface_select.

4.3.176 Component_terminal_to_interconnect_module_terminal_assignment to Component_termination_passage_interface_terminal

Each Component_terminal_to_interconnect_module_terminal_assignment has assigned_terminal defined by zero or one Component_termination_passage_interface_terminal. Each Component_termination_passage_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_interconnect_module_terminal_assignment objects. This assertion is established through interconnect_or_assembly_module_select.

4.3.177 Component_terminal_to_interconnect_module_terminal_assignment to Interconnect_module_terminal

Each Component_terminal_to_interconnect_module_terminal_assignment has usage_view_terminal defined by exactly one Interconnect_module_terminal. Each Interconnect_module_terminal defines usage_view_terminal for zero, one, or more Component_terminal_to_interconnect_module_terminal_assignment objects.

4.3.178 Component_terminal_to_interconnect_module_terminal_assignment to Land_interface_terminal

Each Component_terminal_to_interconnect_module_terminal_assignment has assigned_terminal defined by zero or one Land_interface_terminal. Each Land_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_interconnect_module_terminal_assignment objects. This assertion is established through interconnect_or_assembly_module_select.

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4.3.179 Component_terminal_to_interconnect_module_terminal_assignment to Non_functional_land_interface_terminal

Each Component_terminal_to_interconnect_module_terminal_assignment has assigned_terminal defined by zero or one Non_functional_land_interface_terminal. Each Non_functional_land_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_interconnect_module_terminal_assignment objects. This assertion is established through interconnect_or_assembly_module_select.

4.3.180 Component_terminal_to_interconnect_module_terminal_assignment to Printed_connector_component_interface_terminal

Each Component_terminal_to_interconnect_module_terminal_assignment has assigned_terminal defined by zero or one Printed_connector_component_interface_terminal. Each Printed_connector_component_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_interconnect_module_terminal_assignment objects. This assertion is established through interconnect_or_assembly_module_select.

4.3.181 Component_terminal_to_pca_terminal_assignment to Assembly_module_component_terminal

Each Component_terminal_to_pca_terminal_assignment has assigned_terminal defined by zero or one Assembly_module_component_terminal. Each Assembly_module_component_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_pca_terminal_assignment objects. This assertion is established through pca_interface_select.

4.3.182 Component_terminal_to_pca_terminal_assignment to Component_interface_terminal

Each Component_terminal_to_pca_terminal_assignment has assigned_terminal defined by zero or one Component_interface_terminal. Each Component_interface_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_pca_terminal_assignment objects. This assertion is established through pca_interface_select.

4.3.183 Component_terminal_to_pca_terminal_assignment to Interconnect_module_component_terminal

Each Component_terminal_to_pca_terminal_assignment has assigned_terminal defined by zero or one Interconnect_module_component_terminal. Each Interconnect_module_component_terminal defines assigned_terminal for zero, one, or more Component_terminal_to_pca_terminal_assignment objects. This assertion is established through pca_interface_select.

4.3.184 Component_terminal_to_pca_terminal_assignment to Pca_terminal

Each Component_terminal_to_pca_terminal_assignment has usage_view_terminal defined by exactly one Pca_terminal. Each Pca_terminal defines usage_view_terminal for zero, one, or more Component_terminal_to_pca_terminal_assignment objects.

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4.3.185 Component_termination_passage to Component_termination_passage_template

Each Component_termination_passage has usage_definition defined by exactly one Component_termination_passage_template. Each Component_termination_passage_template defines usage_definition for zero, one, or more Component_termination_passage objects.

4.3.186 Component_termination_passage_and_contact_size_dependent_land to Component_termination_passage

Each Component_termination_passage_and_contact_size_dependent_land has reference_passage defined by exactly one Component_termination_passage. Each Component_termination_passage defines reference_passage for zero, one, or more Component_termination_passage_and_contact_size_dependent_land objects.

4.3.187 Component_termination_passage_and_contact_size_dependent_land to Default_attachment_size_and_component_termination_passage_based_land_physical_template

Each Component_termination_passage_and_contact_size_dependent_land has usage_definition defined by exactly one Default_attachment_size_and_component_termination_passage_based_land_physical_template. Each Default_attachment_size_and_component_termination_passage_based_land_physical_template defines usage_definition for zero, one, or more Component_termination_passage_and_contact_size_dependent_land objects.

4.3.188 Component_termination_passage_and_contact_size_dependent_non_functional_land to Component_termination_passage

Each Component_termination_passage_and_contact_size_dependent_non_functional_land has reference_passage defined by exactly one Component_termination_passage. Each Component_termination_passage defines reference_passage for zero, one, or more Component_termination_passage_and_contact_size_dependent_non_functional_land objects.

4.3.189 Component_termination_passage_and_contact_size_dependent_non_functional_land to Default_attachment_size_and_component_termination_passage_based_land_physical_template

Each Component_termination_passage_and_contact_size_dependent_non_functional_land has usage_definition defined by exactly one Default_attachment_size_and_component_termination_passage_based_land_physical_template. Each Default_attachment_size_and_component_termination_passage_based_land_physical_template defines usage_definition for zero, one, or more Component_termination_passage_and_contact_size_dependent_non_functional_land objects.

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4.3.190 Component_termination_passage_dependent_land to Component_termination_passage

Each Component_termination_passage_dependent_land has reference_passage defined by exactly one Component_termination_passage. Each Component_termination_passage defines reference_passage for zero, one, or more Component_termination_passage_dependent_land objects.

4.3.191 Component_termination_passage_dependent_land to Default_component_termination_passage_based_land_physical_template

Each Component_termination_passage_dependent_land has usage_definition defined by exactly one Default_component_termination_passage_based_land_physical_template. Each Default_component_termination_passage_based_land_physical_template defines usage_definition for zero, one, or more Component_termination_passage_dependent_land objects.

4.3.192 Component_termination_passage_dependent_non_functional_land to Component_termination_passage

Each Component_termination_passage_dependent_non_functional_land has reference_passage defined by exactly one Component_termination_passage. Each Component_termination_passage defines reference_passage for zero, one, or more Component_termination_passage_dependent_non_functional_land objects.

4.3.193 Component_termination_passage_dependent_non_functional_land to Default_component_termination_passage_based_land_physical_template

Each Component_termination_passage_dependent_non_functional_land has usage_definition defined by exactly one Default_component_termination_passage_based_land_physical_template. Each Default_component_termination_passage_based_land_physical_template defines usage_definition for zero, one, or more Component_termination_passage_dependent_non_functional_land objects.

4.3.194 Component_termination_passage_interface_terminal to Component_termination_passage

Each Component_termination_passage_interface_terminal has associated_component defined by exactly one Component_termination_passage. Each Component_termination_passage has interface_access_mechanism defined by exactly one Component_termination_passage_interface_terminal.

4.3.195 Component_termination_passage_interface_terminal to Component_termination_passage_template_interface_terminal

Each Component_termination_passage_interface_terminal has definition defined by exactly one Component_termination_passage_template_interface_terminal. Each Component_termination_passage_template_interface_terminal defines definition for zero, one, or more Component_termination_passage_interface_terminal objects.

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4.3.196 Component_termination_passage_join_terminal to Component_termination_passage

Each Component_termination_passage_join_terminal has associated_component defined by exactly one Component_termination_passage. Each Component_termination_passage has access_mechanism defined by one or more Component_termination_passage_join_terminal objects.

4.3.197 Component_termination_passage_join_terminal to Component_termination_passage_template_join_terminal

Each Component_termination_passage_join_terminal has definition defined by exactly one Component_termination_passage_template_join_terminal. Each Component_termination_passage_template_join_terminal defines definition for zero, one, or more Component_termination_passage_join_terminal objects.

4.3.198 Component_termination_passage_template to Default_component_termination_passage_definition

Each Component_termination_passage_template has of_passage_technology defined by exactly one Default_component_termination_passage_definition. Each Default_component_termination_passage_definition defines of_passage_technology for zero, one, or more Component_termination_passage_template objects.

4.3.199 Component_termination_passage_template_terminal to Component_termination_passage_template

Each Component_termination_passage_template_terminal has associated_definition defined by exactly one Component_termination_passage_template. Each Component_termination_passage_template has access_mechanisms defined by two or more Component_termination_passage_template_terminal objects.

4.3.200 Component_termination_passage_template_terminal to Connection_zone

Each Component_termination_passage_template_terminal has terminal_connection_zone defined by one or more Connection_zone objects. Each Connection_zone defines terminal_connection_zone for zero, one, or more Component_termination_passage_template_terminal objects.

4.3.201 Composite_curve to Composite_curve_segment

Each Composite_curve has curve_segment defined by one or more Composite_curve_segment objects. Each Composite_curve_segment has using_curves defined by one or more Composite_curve objects.

4.3.202 Composite_curve_segment to Curve

Each Composite_curve_segment has segment_curve defined by exactly one Curve. Each Curve defines segment_curve for zero, one, or more Composite_curve_segment objects.

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4.3.203 Composite_feature_relating_position_tolerance to Composite_feature_locating_position_tolerance

Each Composite_feature_relating_position_tolerance has refined_control defined by zero or one Composite_feature_locating_position_tolerance. Each Composite_feature_locating_position_tolerance defines refined_control for zero, one, or more Composite_feature_relating_position_tolerance objects. This assertion is established through locating_or_relating_position_tolerance.

4.3.204 Composite_feature_relating_position_tolerance to Composite_feature_relating_position_tolerance

Each Composite_feature_relating_position_tolerance has refined_control defined by zero or one Composite_feature_relating_position_tolerance. Each Composite_feature_relating_position_tolerance defines refined_control for zero, one, or more Composite_feature_relating_position_tolerance objects. This assertion is established through locating_or_relating_position_tolerance.

4.3.205 Composite_linear_profile_refinement_tolerance to Composite_linear_profile_locating_tolerance

Each Composite_linear_profile_refinement_tolerance has refined_control defined by zero or one Composite_linear_profile_locating_tolerance. Each Composite_linear_profile_locating_tolerance defines refined_control for zero, one, or more Composite_linear_profile_refinement_tolerance objects. This assertion is established through locating_or_refinement_linear_profile_tolerance.

4.3.206 Composite_linear_profile_refinement_tolerance to Composite_linear_profile_refinement_tolerance

Each Composite_linear_profile_refinement_tolerance has refined_control defined by zero or one Composite_linear_profile_refinement_tolerance. Each Composite_linear_profile_refinement_tolerance defines refined_control for zero, one, or more Composite_linear_profile_refinement_tolerance objects. This assertion is established through locating_or_refinement_linear_profile_tolerance.

4.3.207 Composite_signal_property_relationship to Composite_signal_property

Each Composite_signal_property_relationship has composition defined by exactly one Composite_signal_property. Each Composite_signal_property has signal_property_structure defined by one or more Composite_signal_property_relationship objects.

4.3.208 Composite_signal_property_relationship to External_definition

Each Composite_signal_property_relationship has aggregation_operation defined by exactly one External_definition. Each External_definition defines aggregation_operation for zero, one, or more Composite_signal_property_relationship objects.

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4.3.209 Composite_signal_property_relationship to Signal_property

Each Composite_signal_property_relationship has signal_property_structural_element defined by exactly one Signal_property. Each Signal_property defines signal_property_structural_element for zero, one, or more Composite_signal_property_relationship objects.

4.3.210 Composite_surface_profile_refinement_tolerance to Composite_surface_profile_locating_tolerance

Each Composite_surface_profile_refinement_tolerance has refined_control defined by zero or one Composite_surface_profile_locating_tolerance. Each Composite_surface_profile_locating_tolerance defines refined_control for zero, one, or more Composite_surface_profile_refinement_tolerance objects. This assertion is established through locating_or_refinement_surface_profile_tolerance.

4.3.211 Composite_surface_profile_refinement_tolerance to Composite_surface_profile_refinement_tolerance

Each Composite_surface_profile_refinement_tolerance has refined_control defined by zero or one Composite_surface_profile_refinement_tolerance. Each Composite_surface_profile_refinement_tolerance defines refined_control for zero, one, or more Composite_surface_profile_refinement_tolerance objects. This assertion is established through locating_or_refinement_surface_profile_tolerance.

4.3.212 Conductive_interconnect_element to Layer_connection_point

Each Conductive_interconnect_element has connected_point defined by one or more Layer_connection_point objects. Each Layer_connection_point defines connected_point for zero, one, or more Conductive_interconnect_element objects.

4.3.213 Conductive_interconnect_element to Stratum_feature

Each Conductive_interconnect_element has composed_conductor defined by exactly one Stratum_feature. Each Stratum_feature defines composed_conductor for zero, one, or more Conductive_interconnect_element objects.

4.3.214 Conductive_interconnect_element_terminal to Conductive_interconnect_element

Each Conductive_interconnect_element_terminal has associated_component defined by exactly one Conductive_interconnect_element. Each Conductive_interconnect_element has access_mechanisms defined by exactly two Conductive_interconnect_element_terminal.

4.3.215 Conductive_interconnect_element_terminal to Connection_zone

Each Conductive_interconnect_element_terminal has connection defined by exactly one Connection_zone. Each Connection_zone defines connection for zero, one, or more Conductive_interconnect_element_terminal objects.

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4.3.216 Conductive_interconnect_element_with_pre_defined_transitions to Styled_curve_occurrence

Each Conductive_interconnect_element_with_pre_defined_transitions has shape_representation defined by exactly one Styled_curve_occurrence. Each Styled_curve_occurrence defines shape_representation for exactly one Conductive_interconnect_element_with_pre_defined_transitions objects. This assertion is established through styled_curve_or_bound_surface.

4.3.217 Conductive_interconnect_element_with_pre_defined_transitions to Trace_template

Each Conductive_interconnect_element_with_pre_defined_transitions has usage_definition defined by exactly one Trace_template. Each Trace_template defines usage_definition for zero, one, or more Conductive_interconnect_element_with_pre_defined_transitions objects.

4.3.218 Conductive_interconnect_element_with_user_defined_single_transition to Bounding_curve

Each Conductive_interconnect_element_with_user_defined_single_transition has left_curve_shape_representation defined by zero or one Bounding_curve. Each Bounding_curve defines left_curve_shape_representation for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects. This assertion is established through trimmed_or_bounding_curve.

Each Conductive_interconnect_element_with_user_defined_single_transition has right_curve_shape_representation defined by zero or one Bounding_curve. Each Bounding_curve defines right_curve_shape_representation for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects. This assertion is established through trimmed_or_bounding_curve.

4.3.219 Conductive_interconnect_element_with_user_defined_single_transition to Layer_connection_point

Each Conductive_interconnect_element_with_user_defined_single_transition has end_terminus defined by exactly one Layer_connection_point. Each Layer_connection_point defines end_terminus for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects.

Each Conductive_interconnect_element_with_user_defined_single_transition has start_terminus defined by exactly one Layer_connection_point. Each Layer_connection_point defines start_terminus for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects.

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4.3.220 Conductive_interconnect_element_with_user_defined_single_transition to Trace_template

Each Conductive_interconnect_element_with_user_defined_single_transition has end_definition defined by exactly one Trace_template. Each Trace_template defines end_definition for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects.

Each Conductive_interconnect_element_with_user_defined_single_transition has start_definition defined by exactly one Trace_template. Each Trace_template defines start_definition for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects.

4.3.221 Conductive_interconnect_element_with_user_defined_single_transition to Trimmed_line

Each Conductive_interconnect_element_with_user_defined_single_transition has left_curve_shape_representation defined by zero or one Trimmed_line. Each Trimmed_line defines left_curve_shape_representation for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects. This assertion is established through trimmed_or_bounding_curve.

Each Conductive_interconnect_element_with_user_defined_single_transition has right_curve_shape_representation defined by zero or one Trimmed_line. Each Trimmed_line defines right_curve_shape_representation for zero, one, or more Conductive_interconnect_element_with_user_defined_single_transition objects. This assertion is established through trimmed_or_bounding_curve.

4.3.222 Conductor to Intra_stratum_join_relationship

Each Conductor has implementation_requirement defined by one Intra_stratum_join_relationship objects. Each Intra_stratum_join_relationship has ordered_implementation defined by zero or one Conductor.

4.3.223 Configuration_controlled_message to Ee_approval

Each Configuration_controlled_message has message_source defined by zero or one Ee_approval. Each Ee_approval defines message_source for zero, one, or more Configuration_controlled_message objects. This assertion is established through message_source_select.

4.3.224 Configuration_controlled_message to Ee_product_version

Each Configuration_controlled_message has message_source defined by zero or one Ee_product_version. Each Ee_product_version defines message_source for zero, one, or more Configuration_controlled_message objects. This assertion is established through message_source_select.

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4.3.225 Configuration_controlled_message to Organization

Each Configuration_controlled_message has message_source defined by zero or one Organization. Each Organization defines message_source for zero, one, or more Configuration_controlled_message objects. This assertion is established through message_source_select.

4.3.226 Conical_tolerance_zone_boundary_and_surface_relationship to Conical_tolerance_zone_boundary

Each Conical_tolerance_zone_boundary_and_surface_relationship has sized_tolerance_zone_boundary defined by exactly one Conical_tolerance_zone_boundary. Each Conical_tolerance_zone_boundary has boundary_and_surface_relationships defined by exactly two Conical_tolerance_zone_boundary_and_-surface_relationship.

4.3.227 Conical_tolerance_zone_boundary_and_surface_relationship to Physical_feature_or_part_template

Each Conical_tolerance_zone_boundary_and_surface_relationship has terminating_surface defined by exactly one Physical_feature_or_part_template. Each Physical_feature_or_part_template defines terminating_surface for zero, one, or more Conical_tolerance_zone_boundary_and_surface_relationship objects.

4.3.228 Conical_tolerance_zone_boundary_definition to Conical_tolerance_zone_boundary

Each Conical_tolerance_zone_boundary_definition has defined_zone_boundary defined by exactly one Conical_tolerance_zone_boundary. Each Conical_tolerance_zone_boundary defines defined_zone_boundary for zero, one, or more Conical_tolerance_zone_boundary_definition objects.

4.3.229 Conical_tolerance_zone_boundary_definition to Conical_tolerance_zone_boundary_diametrical_size_characteristic

Each Conical_tolerance_zone_boundary_definition has boundary_sizes defined by exactly two Conical_tolerance_zone_boundary_diametrical_size_characteristic objects. Each Conical_tolerance_zone_-boundary_diametrical_size_characteristic has boundary_definition defined by exactly one Conical_tolerance_zone_boundary_definition.

4.3.230 Conical_tolerance_zone_boundary_diametrical_size_characteristic to Conical_tolerance_zone_boundary_and_surface_relationship

Each Conical_tolerance_zone_boundary_diametrical_size_characteristic has sized_boundary_at_surface defined by exactly one Conical_tolerance_zone_boundary_and_surface_relationship. Each Conical_tolerance_zone_boundary_and_surface_relationship has size_characteristic defined by exactly one Conical_tolerance_zone_boundary_diametrical_size_characteristic.

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4.3.231 Conical_tolerance_zone_boundary_diametrical_size_characteristic to Length_data_element

Each Conical_tolerance_zone_boundary_diametrical_size_characteristic has tolerance_value defined by exactly one Length_data_element. Each Length_data_element defines tolerance_value for zero, one, or more Conical_tolerance_zone_boundary_diametrical_size_characteristic objects.

4.3.232 Conical_tolerance_zone_definition to Conical_tolerance_zone_boundary_definition

Each Conical_tolerance_zone_definition has boundary_definition defined by exactly one Conical_tolerance_zone_boundary_definition. Each Conical_tolerance_zone_boundary_definition defines boundary_definition for zero, one, or more Conical_tolerance_zone_definition objects.

4.3.233 Connected_filled_area to Intra_stratum_join_relationship

Each Connected_filled_area has implementation_requirement defined by exactly one Intra_stratum_join_relationship. Each Intra_stratum_join_relationship has random_implementation defined by zero or one Connected_filled_area.

4.3.234 Connection_zone to Ee_colour

Each Connection_zone has representation_colour defined by exactly one Ee_colour objects.

4.3.235 Connection_zone to Feature_shape_occurrence

Each Connection_zone has zone_shape defined by one or more Feature_shape_occurrence objects. Each Feature_shape_occurrence defines zone_shape for zero, one, or more Connection_zone objects.

4.3.236 Connection_zone_model_port_assignment to Analytical_model_port

Each Connection_zone_model_port_assignment has target defined by exactly one Analytical_model_port. Each Analytical_model_port defines target for zero, one, or more Connection_zone_model_port_assignment objects.

4.3.237 Connection_zone_model_port_assignment to Connection_zone

Each Connection_zone_model_port_assignment has source defined by exactly one Connection_zone. Each Connection_zone defines source for zero, one, or more Connection_zone_model_port_assignment objects.

4.3.238 Connectivity_allocation to Aggregate_connectivity_requirement

Each Connectivity_allocation has connectivity_requirement defined by one or more Aggregate_connectivity_requirement objects. Each Aggregate_connectivity_requirement defines connectivity_requirement for zero, one, or more Connectivity_allocation objects.

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4.3.239 Connectivity_allocation to Physical_connectivity_definition

Each Connectivity_allocation has implementation defined by exactly one Physical_connectivity_definition. Each Physical_connectivity_definition defines implementation for zero, one, or more Connectivity_allocation objects.

4.3.240 Connectivity_sub_structure to Component_terminal

Each Connectivity_sub_structure has members defined by zero or more Component_terminal objects. Each Component_terminal defines members for zero, one, or more Connectivity_sub_structure objects. This assertion is established through termination_or_junction.

4.3.241 Connectivity_sub_structure to Topological_junction

Each Connectivity_sub_structure has members defined by zero or more Topological_junction objects. Each Topological_junction defines members for zero, one, or more Connectivity_sub_structure objects. This assertion is established through termination_or_junction.

4.3.242 Consistent_part_template_shape_projection to Part_template_3d_shape

Each Consistent_part_template_shape_projection has projected_3d_shape defined by exactly one Part_template_3d_shape. Each Part_template_3d_shape defines projected_3d_shape for zero, one, or more Consistent_part_template_shape_projection objects.

4.3.243 Consistent_part_template_shape_projection to Part_template_planar_shape

Each Consistent_part_template_shape_projection has resultant_planar_shape defined by exactly one Part_template_planar_shape. Each Part_template_planar_shape defines resultant_planar_shape for zero, one, or more Consistent_part_template_shape_projection objects.

4.3.244 Consistent_physical_unit_shape_projection to Physical_unit_3d_shape

Each Consistent_physical_unit_shape_projection has projected_3d_shape defined by exactly one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines projected_3d_shape for zero, one, or more Consistent_physical_unit_shape_projection objects.

4.3.245 Consistent_physical_unit_shape_projection to Physical_unit_planar_shape

Each Consistent_physical_unit_shape_projection has resultant_planar_shape defined by exactly one Physical_unit_planar_shape. Each Physical_unit_planar_shape defines resultant_planar_shape for zero, one, or more Consistent_physical_unit_shape_projection objects.

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4.3.246 Consistent_stratum_shape_projection to Stratum_3d_shape

Each Consistent_stratum_shape_projection has projected_3d_shape defined by exactly one Stratum_3d_shape. Each Stratum_3d_shape defines projected_3d_shape for zero, one, or more Consistent_stratum_shape_projection objects.

4.3.247 Consistent_stratum_shape_projection to Stratum_planar_shape

Each Consistent_stratum_shape_projection has resultant_planar_shape defined by exactly one Stratum_planar_shape. Each Stratum_planar_shape defines resultant_planar_shape for zero, one, or more Consistent_stratum_shape_projection objects.

4.3.248 Constraint_occurrence to Ee_rule_version

Each Constraint_occurrence has design_constraint defined by exactly one Ee_rule_version. Each Ee_rule_version defines design_constraint for zero, one, or more Constraint_occurrence objects.

4.3.249 Contact_size_dependent_land to Default_attachment_size_based_land_physical_template

Each Contact_size_dependent_land has usage_definition defined by exactly one Default_attachment_size_based_land_physical_template. Each Default_attachment_size_based_land_physical_template defines usage_definition for zero, one, or more Contact_size_dependent_land objects.

4.3.250 Contact_size_dependent_non_functional_land to Default_attachment_size_based_land_physical_template

Each Contact_size_dependent_non_functional_land has usage_definition defined by exactly one Default_attachment_size_based_land_physical_template. Each Default_attachment_size_based_land_physical_template defines usage_definition for zero, one, or more Contact_size_dependent_non_functional_land objects.

4.3.251 Contract to Date

Each Contract has contract_date defined by zero or one Date. Each Date defines contract_date for zero, one, or more Contract objects. This assertion is established through date_or_date_and_time.

4.3.252 Contract to Date_and_time

Each Contract has contract_date defined by zero or one Date_and_time. Each Date_and_time defines contract_date for zero, one, or more Contract objects. This assertion is established through date_or_date_and_time.

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4.3.253 Contract to Ee_approval

Each Contract has contract_approval defined by exactly one Ee_approval. Each Ee_approval defines contract_approval for zero, one, or more Contract objects.

4.3.254 Contract to Ee_text

Each Contract has contract_number defined by exactly one Ee_text. Each Ee_text defines contract_number for zero, one, or more Contract objects.

4.3.255 Contract to Organization

Each Contract has contractor defined by zero or one Organization. Each Organization defines contractor for zero, one, or more Contract objects. This assertion is established through person_organization.

4.3.256 Contract to Person_and_organization

Each Contract has contractor defined by zero or one Person_and_organization. Each Person_and_organization defines contractor for zero, one, or more Contract objects. This assertion is established through person_organization.

4.3.257 Coordinated_characteristic to Characteristic

Each Coordinated_characteristic has component_characteristic defined by one or more Characteristic objects. Each Characteristic defines component_characteristic for zero, one, or more Coordinated_characteristic objects.

4.3.258 Coordinated_characteristic to Ee_document

Each Coordinated_characteristic has reference_document defined by zero or one Ee_document. Each Ee_document defines reference_document for zero, one, or more Coordinated_characteristic objects. This assertion is established through standard_or_reference_document.

4.3.259 Counterbore_passage_template to Blind_passage_template

Each Counterbore_passage_template has larger_passage defined by exactly one Blind_passage_template. Each Blind_passage_template defines larger_passage for zero, one, or more Counterbore_passage_template objects.

4.3.260 Counterbore_passage_template to Unsupported_passage_template

Each Counterbore_passage_template has smaller_passage defined by exactly one Unsupported_passage_template. Each Unsupported_passage_template defines smaller_passage for zero, one, or more Counterbore_passage_template objects.

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4.3.261 Countersunk_passage_template to Blind_passage_template

Each Countersunk_passage_template has tapered_passage defined by exactly one Blind_passage_template. Each Blind_passage_template defines tapered_passage for zero, one, or more Countersunk_passage_template objects.

4.3.262 Countersunk_passage_template to Unsupported_passage_template

Each Countersunk_passage_template has constant_diameter_passage defined by exactly one Unsupported_passage_template. Each Unsupported_passage_template defines constant_diameter_passage for zero, one, or more Countersunk_passage_template objects.

4.3.263 Curve_style to Curve_style_font

Each Curve_style has curve_font defined by zero or one Curve_style_font. Each Curve_style_font defines curve_font for zero, one, or more Curve_style objects. This assertion is established through curve_font_or_scaled_curve_font_select and Curve_style_font_select.

4.3.264 Curve_style to Curve_style_font_and_scaling

Each Curve_style has curve_font defined by zero or one Curve_style_font_and_scaling. Each Curve_style_font_and_scaling defines curve_font for zero, one, or more Curve_style objects. This assertion is established through curve_font_or_scaled_curve_font_select.

4.3.265 Curve_style to Data_element

Each Curve_style has extension defined by zero or one Data_element. Each Data_element defines extension for zero, one, or more Curve_style objects.

4.3.266 Curve_style to Externally_defined_curve_font

Each Curve_style has curve_font defined by zero or one Externally_defined_curve_font. Each Externally_defined_curve_font defines curve_font for zero, one, or more Curve_style objects. This assertion is established through curve_font_or_scaled_curve_font_select and Curve_style_font_select.

4.3.267 Curve_style to Length_data_element

Each Curve_style has curve_width defined by exactly one Length_data_element. Each Length_data_element defines curve_width for zero, one, or more Curve_style objects.

4.3.268 Curve_style to Solid_curve

Each Curve_style has curve_font defined by zero or one Solid_curve. Each Solid_curve defines curve_font for zero, one, or more Curve_style objects. This assertion is established through curve_font_or_scaled_curve_font_select and Curve_style_font_select.

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4.3.269 Curve_style_font_and_scaling to Curve_style_font

Each Curve_style_font_and_scaling has curve_font defined by zero or one Curve_style_font. Each Curve_style_font defines curve_font for zero, one, or more Curve_style_font_and_scaling objects. This assertion is established through curve_style_font_select.

4.3.270 Curve_style_font_and_scaling to Externally_defined_curve_font

Each Curve_style_font_and_scaling has curve_font defined by zero or one Externally_defined_curve_font. Each Externally_defined_curve_font defines curve_font for zero, one, or more Curve_style_font_and_scaling objects. This assertion is established through curve_style_font_select.

4.3.271 Curve_style_font_and_scaling to Positive_ratio_measure

Each Curve_style_font_and_scaling has curve_font_scaling defined by exactly one Positive_ratio_measure. Each Positive_ratio_measure defines curve_font_scaling for zero, one, or more Curve_style_font_and_scaling objects.

4.3.272 Curve_style_font_and_scaling to Solid_curve

Each Curve_style_font_and_scaling has curve_font defined by zero or one Solid_curve. Each Solid_curve defines curve_font for zero, one, or more Curve_style_font_and_scaling objects. This assertion is established through curve_style_font_select.

4.3.273 Cutout_edge_segment to Cutout

Each Cutout_edge_segment has composed_cutout defined by exactly one Cutout. Each Cutout defines composed_cutout for zero, one, or more Cutout_edge_segment objects.

4.3.274 Datum_axis_and_tolerance_zone_orienting_relationship to Datum_axis

Each Datum_axis_and_tolerance_zone_orienting_relationship has orienting_datum_axis defined by exactly one Datum_axis. Each Datum_axis defines orienting_datum_axis for zero, one, or more Datum_axis_and_tolerance_zone_orienting_relationship objects.

4.3.275 Datum_axis_and_tolerance_zone_orienting_relationship to Tolerance_zone

Each Datum_axis_and_tolerance_zone_orienting_relationship has oriented_tolerance_zone defined by exactly one Tolerance_zone. Each Tolerance_zone defines oriented_tolerance_zone for zero, one, or more Datum_axis_and_tolerance_zone_orienting_relationship objects.

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4.3.276 Datum_axis_related_orientation to Datum_axis_and_tolerance_zone_orienting_relationship

Each Datum_axis_related_orientation has orienting_relationship defined by exactly one Datum_axis_-and_tolerance_zone_orienting_relationship. Each Datum_axis_and_tolerance_zone_orienting_relationship has zone_orientation defined by exactly one Datum_axis_related_orientation.

4.3.277 Datum_based_direction_vector to Axis_placement

Each Datum_based_direction_vector has direction_vector_representation defined by exactly one Axis_-placement. Each Axis_placement defines direction_vector_representation for zero, one, or more Datum_based_direction_vector objects.

4.3.278 Datum_based_direction_vector to Datum_plane

Each Datum_based_direction_vector has vector_of defined by exactly one Datum_plane. Each Datum_-plane defines vector_of for zero, one, or more Datum_based_direction_vector objects.

4.3.279 Datum_based_length_measure to Datum

Each Datum_based_length_measure has of_datum defined by exactly one Datum. Each Datum defines of_datum for zero, one, or more Datum_based_length_measure objects.

4.3.280 Datum_based_length_measure to Length_data_element

Each Datum_based_length_measure has measure defined by exactly one Length_data_element. Each Length_data_element defines measure for zero, one, or more Datum_based_length_measure objects.

4.3.281 Datum_based_length_measure to Orientation

Each Datum_based_length_measure has measure_orientation defined by exactly one Orientation. Each Orientation defines measure_orientation for zero, one, or more Datum_based_length_measure objects.

4.3.282 Datum_based_vector_orientation to Direction_element

Each Datum_based_vector_orientation has direction_components defined by exactly three Direction_element objects. Each Direction_element has elements_of defined by one or more Datum_based_vector_-orientation objects.

4.3.283 Datum_feature_material_condition_property to Datum_feature_usage_in_datum_system_relationship

Each Datum_feature_material_condition_property has applied_to defined by exactly one Datum_feature_usage_in_datum_system_relationship. Each Datum_feature_usage_in_datum_system_relationship has applied_material_condition_property defined by exactly one Datum_feature_material_condition_-property.

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4.3.284 Datum_feature_usage_in_common_datum_relationship to Common_datum

Each Datum_feature_usage_in_common_datum_relationship has relating_shape_element defined by exactly one Common_datum. Each Common_datum defines relating_shape_element for zero, one, or more Datum_feature_usage_in_common_datum_relationship objects.

4.3.285 Datum_feature_usage_in_datum_relationship to Datum

Each Datum_feature_usage_in_datum_relationship has relating_shape_element defined by exactly one Datum. Each Datum has datum_feature_usages defined by zero or more Datum_feature_usage_in_datum_relationship objects.

4.3.286 Datum_feature_usage_in_datum_relationship to Datum_feature

Each Datum_feature_usage_in_datum_relationship has related_shape_element defined by exactly one Datum_feature. Each Datum_feature has datum_feature_usages defined by one or more Datum_feature_usage_in_datum_relationship objects.

4.3.287 Datum_feature_usage_in_datum_system_relationship to Datum_feature

Each Datum_feature_usage_in_datum_system_relationship has used_datum_feature defined by exactly one Datum_feature. Each Datum_feature defines used_datum_feature for zero, one, or more Datum_feature_usage_in_datum_system_relationship objects.

4.3.288 Datum_feature_usage_in_datum_system_relationship to Datum_system

Each Datum_feature_usage_in_datum_system_relationship has established_datum_system defined by exactly one Datum_system. Each Datum_system defines established_datum_system for zero, one, or more Datum_feature_usage_in_datum_system_relationship objects.

4.3.289 Datum_feature_usage_in_single_datum_relationship to Single_datum

Each Datum_feature_usage_in_single_datum_relationship has relating_shape_element defined by exactly one Single_datum. Each Single_datum defines relating_shape_element for zero, one, or more Datum_feature_usage_in_single_datum_relationship objects.

4.3.290 Datum_precedence_assignment to Datum_usage_in_datum_system_relationship

Each Datum_precedence_assignment has assigned_to defined by exactly one Datum_usage_in_datum_system_relationship. Each Datum_usage_in_datum_system_relationship has precedence_assignment defined by exactly one Datum_precedence_assignment.

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4.3.291 Datum_reference_frame to Datum_axis

Each Datum_reference_frame has reference_axes defined by zero, one, two, or three Datum_axis objects. Each Datum_axis defines reference_axes for zero, one, or more Datum_reference_frame objects.

4.3.292 Datum_reference_frame to Datum_plane

Each Datum_reference_frame has reference_planes defined by zero, one, two, or three Datum_plane objects. Each Datum_plane defines reference_planes for zero, one, or more Datum_reference_frame objects.

4.3.293 Datum_reference_frame to Datum_point

Each Datum_reference_frame has reference_origin defined by zero or one Datum_point. Each Datum_point defines reference_origin for zero, one, or more Datum_reference_frame objects.

4.3.294 Datum_system to Datum_reference_frame

Each Datum_system has established_datum_reference_frame defined by exactly one Datum_reference_frame. Each Datum_reference_frame has used_datum_systems defined by one or more Datum_system objects.

4.3.295 Datum_system_defining_conditions to Datum_precedence_assignment

Each Datum_system_defining_conditions has assigned_datum_precedences defined by one, two, or three Datum_precedence_assignment objects. Each Datum_precedence_assignment has datum_system_conditions_definition defined by exactly one Datum_system_defining_conditions.

4.3.296 Datum_system_defining_conditions to Datum_system

Each Datum_system_defining_conditions has conditions_of defined by exactly one Datum_system. Each Datum_system has defining_conditions defined by exactly one Datum_system_defining_conditions.

4.3.297 Datum_system_defining_conditions_with_material_conditions to Datum_feature_material_condition_property

Each Datum_system_defining_conditions_with_material_conditions has applied_material_condition_properties defined by one or more Datum_feature_material_condition_property objects. Each Datum_feature_material_condition_property has datum_system_conditions_definition defined by exactly one Datum_system_defining_conditions_with_material_conditions.

4.3.298 Datum_target_usage_in_datum_target_set_relationship to Datum_target

Each Datum_target_usage_in_datum_target_set_relationship has used_datum_target defined by exactly one Datum_target. Each Datum_target has datum_target_usages defined by one or more Datum_target_usage_in_datum_target_set_relationship objects.

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4.3.299 Datum_target_usage_in_datum_target_set_relationship to Datum_target_set

Each Datum_target_usage_in_datum_target_set_relationship has defined_datum_target_set defined by exactly one Datum_target_set. Each Datum_target_set has included_datum_targets defined by one or more Datum_target_usage_in_datum_target_set_relationship objects.

4.3.300 Datum_usage_in_datum_system_relationship to Datum

Each Datum_usage_in_datum_system_relationship has used_datum defined by exactly one Datum. Each Datum defines used_datum for zero, one, or more Datum_usage_in_datum_system_relationship objects.

4.3.301 Datum_usage_in_datum_system_relationship to Datum_system

Each Datum_usage_in_datum_system_relationship has established_datum_system defined by exactly one Datum_system. Each Datum_system has datum_usages defined by one, two, or three Datum_usage_in_datum_system_relationship objects.

4.3.302 Default_assembly_bond_shape to Assembly_bond_definition

Each Default_assembly_bond_shape has characterized_bond_definition defined by exactly one Assembly_bond_definition. Each Assembly_bond_definition has default_shape defined by zero or one Default_assembly_bond_shape.

4.3.303 Default_attachment_size_based_land_physical_template to Connection_Zone

Each Default_attachment_size_based_land_physical_template has minimum_attachment_zone defined by exactly one Connection_Zone. Each Default_attachment_size_based_land_physical_template has maximum_attachment_zone defined by exactly one Connection_Zone.

4.3.304 Default_attachment_size_based_land_physical_template to External_definition

Each Default_attachment_size_based_land_physical_template has attachment_region_size defined by exactly one External_definition. Each External_definition defines attachment_region_size for zero, one, or more Default_attachment_size_based_land_physical_template objects.

4.3.305 Default_component_termination_passage_based_land_physical_template to Default_component_termination_passage_definition

Each Default_component_termination_passage_based_land_physical_template has of_passage_technology defined by exactly one Default_component_termination_passage_definition. Each Default_component_termination_passage_definition defines of_passage_technology for zero, one, or more Default_component_termination_passage_based_land_physical_template objects.

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4.3.306 Default_component_termination_passage_definition to Ee_material

Each Default_component_termination_passage_definition has deposition_material defined by exactly one Ee_material. Each Ee_material defines deposition_material for zero, one, or more Default_component_termination_passage_definition objects.

4.3.307 Default_component_termination_passage_definition to Length_data_element

Each Default_component_termination_passage_definition has maximum_allowed_component_terminal_extent defined by exactly one Length_data_element. Each Length_data_element defines maximum_allowed_component_terminal_extent for zero, one, or more Default_component_termination_passage_definition objects.

Each Default_component_termination_passage_definition has minimum_allowed_component_terminal_extent defined by exactly one Length_data_element. Each Length_data_element defines minimum_allowed_component_terminal_extent for zero, one, or more Default_component_termination_passage_definition objects.

Each Default_component_termination_passage_definition has minimum_as_finished_deposition_thickness defined by exactly one Length_data_element. Each Length_data_element defines minimum_as_finished_deposition_thickness for zero, one, or more Default_component_termination_passage_definition objects.

Each Default_component_termination_passage_definition has minimum_as_finished_passage_extent defined by exactly one Length_data_element. Each Length_data_element defines minimum_as_finished_passage_extent for zero, one, or more Default_component_termination_passage_definition objects.

4.3.308 Default_land_physical_template to Stratum_technology

Each Default_land_physical_template has of_stratum_technology defined by exactly one Stratum_technology. Each Stratum_technology defines of_stratum_technology for zero, one, or more Default_land_physical_template objects.

4.3.309 Default_passage_based_land_physical_template to Length_data_element

Each Default_passage_based_land_physical_template has minimum_annular_ring defined by exactly one Length_data_element. Each Length_data_element defines minimum_annular_ring for zero, one, or more Default_passage_based_land_physical_template objects.

Each Default_passage_based_land_physical_template has minimum_fabrication_allowance defined by exactly one Length_data_element. Each Length_data_element defines minimum_fabrication_allowance for zero, one, or more Default_passage_based_land_physical_template objects.

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4.3.310 Default_passage_based_land_physical_template to Passage_technology

Each Default_passage_based_land_physical_template has of_passage_technology defined by exactly one Passage_technology. Each Passage_technology defines of_passage_technology for zero, one, or more Default_passage_based_land_physical_template objects.

4.3.311 Default_trace_template to Stratum_technology

Each Default_trace_template has of_stratum_technology defined by exactly one Stratum_technology. Each Stratum_technology defines of_stratum_technology for zero, one, or more Default_trace_template objects.

4.3.312 Default_unsupported_passage_based_land_physical_template to Default_unsupported_passage_definition

Each Default_unsupported_passage_based_land_physical_template has of_passage_technology defined by exactly one Default_unsupported_passage_definition. Each Default_unsupported_passage_definition defines of_passage_technology for zero, one, or more Default_unsupported_passage_based_land_physical_template objects.

4.3.313 Default_unsupported_passage_definition to Data_length_element

Each Default_unsupported_passage_definition has minimum_as_finished_passage_extent defined as exactly one Length_data_element.

4.3.314 Default_via_based_land_physical_template to Default_via_definition

Each Default_via_based_land_physical_template has of_passage_technology defined by exactly one Default_via_definition. Each Default_via_definition defines of_passage_technology for zero, one, or more Default_via_based_land_physical_template objects.

4.3.315 Default_via_definition to Ee_material

Each Default_via_definition has deposition_material defined by exactly one Ee_material. Each Ee_material defines deposition_material for zero, one, or more Default_via_definition objects.

4.3.316 Default_via_definition to Length_data_element

Each Default_via_definition has minimum_as_finished_deposition_thickness defined by exactly one Length_data_element. Each Length_data_element defines minimum_as_finished_deposition_thickness for zero, one, or more Default_via_definition objects. Each Default_via_defintion has minimum_as_finished_passage_extent defined by exactly one Length_data_element.

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4.3.317 Delete_design_object_management_relationship to Managed_design_object

Each Delete_design_object_management_relationship has previous_design_object defined by exactly one Managed_design_object. Each Managed_design_object defines previous_design_object for zero, one, or more Delete_design_object_management_relationship objects.

4.3.318 Dependently_located_layer_connection_point to Inter_stratum_feature

Each Dependently_located_layer_connection_point has associated_design_object defined by zero or one Inter_stratum_feature. Each Inter_stratum_feature defines associated_design_object for zero, one, or more Dependently_located_layer_connection_point objects. This assertion is established through interconnect_module_terminal_or_inter_stratum_feature.

4.3.319 Dependently_located_layer_connection_point to Interconnect_module_terminal

Each Dependently_located_layer_connection_point has associated_design_object defined by zero or one Interconnect_module_terminal. Each Interconnect_module_terminal defines associated_design_object for zero, one, or more Dependently_located_layer_connection_point objects. This assertion is established through interconnect_module_terminal_or_inter_stratum_feature.

4.3.320 Design_composition_path to Functional_unit

Each Design_composition_path has design_functional_unit defined by exactly one Functional_unit. Each Functional_unit defines design_functional_unit for zero, one, or more Design_composition_path objects.

Each Design_composition_path has path_element defined by one or more Functional_unit objects. Each Functional_unit defines path_element for zero, one, or more Design_composition_path objects.

4.3.321 Design_functional_unit_allocation_to_assembly_component to Assembly_component

Each Design_functional_unit_allocation_to_assembly_component has implementation defined by exactly one Assembly_component. Each Assembly_component defines implementation for zero, one, or more Design_functional_unit_allocation_to_assembly_component objects.

4.3.322 Design_functional_unit_allocation_to_assembly_component to Coordinated_characteristic

Each Design_functional_unit_allocation_to_assembly_component has of_property defined by zero, one or more Coordinated_characteristic object.

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4.3.323 Design_functional_unit_allocation_to_assembly_component to Design_composition_path

Each Design_functional_unit_allocation_to_assembly_component has functional_design_definition_path defined by exactly one Design_composition_path. Each Design_composition_path defines functional_design_definition_path for zero, one, or more Design_functional_unit_allocation_to_assembly_component objects.

4.3.324 Design_functional_unit_allocation_to_assembly_joint to Assembly_joint

Each Design_functional_unit_allocation_to_assembly_joint has implementation defined by exactly one Assembly_joint. Each Assembly_joint defines implementation for zero, one, or more Design_functional_unit_allocation_to_assembly_joint objects.

4.3.325 Design_functional_unit_allocation_to_assembly_joint to Design_composition_path

Each Design_functional_unit_allocation_to_assembly_joint has functional_design_definition_path defined by exactly one Design_composition_path. Each Design_composition_path defines functional_design_definition_path for zero, one, or more Design_functional_unit_allocation_to_assembly_joint objects.

4.3.326 Design_functional_unit_allocation_to_fabrication_joint to Design_composition_path

Each Design_functional_unit_allocation_to_fabrication_joint has functional_design_definition_path defined by exactly one Design_composition_path. Each Design_composition_path defines functional_design_definition_path for zero, one, or more Design_functional_unit_allocation_to_fabrication_joint objects.

4.3.327 Design_functional_unit_allocation_to_fabrication_joint to Fabrication_joint

Each Design_functional_unit_allocation_to_fabrication_joint has implementation defined by exactly one Fabrication_joint. Each Fabrication_joint defines implementation for zero, one, or more Design_functional_unit_allocation_to_fabrication_joint objects.

4.3.328 Design_functional_unit_allocation_to_reference_functional_unit to Design_composition_path

Each Design_functional_unit_allocation_to_reference_functional_unit has design_definition_path defined by exactly one Design_composition_path. Each Design_composition_path defines design_definition_path for zero, one, or more Design_functional_unit_allocation_to_reference_functional_unit objects.

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4.3.329 Design_functional_unit_allocation_to_reference_functional_unit to Reference_composition_path

Each Design_functional_unit_allocation_to_reference_functional_unit has reference_definition_path defined by exactly one Reference_composition_path. Each Reference_composition_path defines reference_definition_path for zero, one, or more Design_functional_unit_allocation_to_reference_functional_unit objects.

4.3.330 Design_intent_modification to Assembly_component

Each Design_intent_modification has modification_causal_item defined by zero or one Assembly_component. Each Assembly_component defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and component_or_component_feature.

4.3.331 Design_intent_modification to Component_feature

Each Design_intent_modification has modification_causal_item defined by zero or one Component_feature. Each Component_feature defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and component_or_component_feature.

4.3.332 Design_intent_modification to Ee_requirement_occurrence

Each Design_intent_modification has modification_causal_item defined by zero or one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item.

4.3.333 Design_intent_modification to Inter_stratum_feature

Each Design_intent_modification has modification_causal_item defined by zero or one Inter_stratum_feature. Each Inter_stratum_feature defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.334 Design_intent_modification to Laminate_component

Each Design_intent_modification has modification_causal_item defined by zero or one Laminate_component. Each Laminate_component defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and Stratum_concept.

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4.3.335 Design_intent_modification to Stratum

Each Design_intent_modification has modification_causal_item defined by zero or one Stratum. Each Stratum defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item.

Each Design_intent_modification has modification_causal_item defined by zero or one Stratum. Each Stratum defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.336 Design_intent_modification to Stratum_feature

Each Design_intent_modification has design_intent defined by exactly one Stratum_feature. Each Stratum_feature defines design_intent for zero, one, or more Design_intent_modification objects.

Each Design_intent_modification has modification_causal_item defined by zero or one Stratum_feature.

Each Stratum_feature defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.337 Design_intent_modification to Stratum_surface

Each Design_intent_modification has modification_causal_item defined by zero or one Stratum_surface. Each Stratum_surface defines modification_causal_item for zero, one, or more Design_intent_modification objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.338 Design_intent_modification_in_stratum_3d_position to Axis_placement_3d

Each Design_intent_modification_in_stratum_3d_position has transformation defined by exactly one Axis_placement_3d.

4.3.339 Design_intent_modification_in_stratum_3d_position to Axis_placement_2d

Each Design_intent_modification_in_stratum_3d_position has transformation defined by exactly one Axis_placement_2d.

4.3.340 Design_intent_modification_3d_shape to Design_intent_modification

Each Design_intent_modification_3d_shape has represented_design_intent_modification defined by exactly one Design_intent_modification.

4.3.341 Design_intent_modification_3d_shape to Bound_volume_shape

Each Design_intent_modification_3d_shape has shape_representation defined by exactly one Bound_volume_shape.

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4.3.342 Design_intent_modification_in_stratum_planar_position to Stratum_3d_shape

Each Design_intent_modification_in_stratum_planar_position has stratum_shape defined by exactly one Stratum_3d_shape.

4.3.343 Design_intent_modification_in_stratum_planar_position to Stratum_Planar_shape

Each Design_intent_modification_in_stratum_planar_position has stratum_shape defined by exactly one Stratum_Planar_shape.

4.3.344 Design_intent_modification_non_planar_2d_shape to Design_intent_modification

Each Design_intent_modification_non_planar_2d_shape has represented_design_intent_modification defined by exactly one Design_intent_modification.

4.3.345 Design_intent_modification_non_planar_2d_shape to Open_shell_based_surface

Each Design_intent_modification_non_planar_2d_shape has shape_representation defined by exactly one Open_shell_based_surface.

4.3.346 Design_intent_modification_planar_shape to Design_intent_modification

Each Design_intent_modification_planar_shape has represented_design_intent_modification defined by exactly one Design_intent_modification.

4.3.347 Design_intent_modification_planar_shape to Planar_projected_shape

Each Design_intent_modification_planar_shape has shape_representation defined by exactly one Planar_projected_shape.

4.3.348 Design_intent_modification_sequence to Design_intent_modification

Each Design_intent_modification_sequence has precedent_modification defined by exactly one Design_intent_modification. Each Design_intent_modification defines precedent_modification for zero, one, or more Design_intent_modification_sequence objects.

Each Design_intent_modification_sequence has subsequent_modification defined by exactly one Design_intent_modification. Each Design_intent_modification defines subsequent_modification for zero, one, or more Design_intent_modification_sequence objects.

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4.3.349 Design_intent_modification_styled_area_representation to Boolean_styled_area_result

Each Design_intent_modification_styled_area_representation has shape_styled_area_representation defined by zero or one Boolean_styled_area_result. Each Boolean_styled_area_result defines shape_styled_area_representation for zero, one, or more Design_intent_modification_styled_area_representation objects. This assertion is established through styled_area_representation.

4.3.350 Design_intent_modification_styled_area_representation to Design_intent_modification

Each Design_intent_modification_styled_area_representation has represented_design_intent_modification defined by exactly one Design_intent_modification. Each Design_intent_modification defines represented_design_intent_modification for zero, one, or more Design_intent_modification_styled_area_representation objects.

4.3.351 Design_intent_modification_styled_area_representation to Fill_area_occurrence

Each Design_intent_modification_styled_area_representation has shape_styled_area_representation defined by zero or one Fill_area_occurrence. Each Fill_area_occurrence defines shape_styled_area_representation for zero, one, or more Design_intent_modification_styled_area_representation objects. This assertion is established through styled_area_representation.

4.3.352 Design_intent_modification_styled_area_representation to Styled_curve_occurrence

Each Design_intent_modification_styled_area_representation has shape_styled_area_representation defined by zero or one Styled_curve_occurrence. Each Styled_curve_occurrence defines shape_styled_area_representation for zero, one, or more Design_intent_modification_styled_area_representation objects. This assertion is established through styled_area_representation.

4.3.353 Design_intent_modification_shape_representation to Design_intent_modification

Each Design_intent_modification_shape_representation has represented_design_intent_modification defined by exactly one Design_intent_modification. Each Design_intent_modification defines represented_design_intent_modification for zero, one, or more Design_intent_modification_shape_representation objects.

4.3.354 Design_layer_stratum to Design_layer_technology

Each Design_layer_stratum has of_technology defined by exactly one Design_layer_technology. Each Design_layer_technology defines of_technology for zero, one, or more Design_layer_stratum objects.

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4.3.355 Design_layer_technology to Length_data_element

Each Design_layer_technology has minimum_finished_feature_spacing defined by exactly one Length_data_element. Each Length_data_element defines minimum_finished_feature_spacing for zero, one, or more Design_layer_technology objects.

4.3.356 Design_object_management_relationship to Ee_product_definition

Each Design_object_management_relationship has current_design defined by exactly one Ee_product_definition. Each Ee_product_definition defines current_design for zero, one, or more Design_object_management_relationship objects.

Each Design_object_management_relationship has previous_design defined by exactly one Ee_product_definition. Each Ee_product_definition defines previous_design for zero, one, or more Design_object_management_relationship objects.

4.3.357 Device_2d_position to Axis_placement_2d

Each Device_2d_position has transformation defined by exactly one Axis_placement_2d. Each Axis_placement_2d defines transformation for zero, one, or more Device_2d_position objects.

4.3.358 Device_2d_position to Part_device

Each Device_2d_position has placed_device defined by exactly one Part_device. Each Part_device has device_2d_position defined by zero or one Device_2d_position.

4.3.359 Device_2d_position to Physical_unit_planar_shape

Each Device_2d_position has device_shape defined by exactly one Physical_unit_planar_shape. Each Physical_unit_planar_shape defines device_shape for zero, one, or more Device_2d_position objects.

Each Device_2d_position has part_shape defined by exactly one Physical_unit_planar_shape. Each Physical_unit_planar_shape defines part_shape for zero, one, or more Device_2d_position objects.

4.3.360 Device_3d_position to Axis_placement_3d

Each Device_3d_position has transformation defined by exactly one Axis_placement_3d. Each Axis_placement_3d defines transformation for zero, one, or more Device_3d_position objects.

4.3.361 Device_3d_position to Part_device

Each Device_3d_position has placed_device defined by exactly one Part_device. Each Part_device has device_3d_position defined by zero or one Device_3d_position.

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4.3.362 Device_3d_position to Physical_unit_3d_shape

Each Device_3d_position has device_shape defined by exactly one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines device_shape for zero, one, or more Device_3d_position objects.

Each Device_3d_position has part_shape defined by exactly one Physical_unit_3d_shape. Each Physical_unit_3d_shape defines part_shape for zero, one, or more Device_3d_position objects.

4.3.363 Device_terminal_map to Packaged_part_terminal

Each Device_terminal_map has target_terminal defined by exactly one Packaged_part_terminal. Each Packaged_part_terminal defines target_terminal for zero, one, or more Device_terminal_map objects.

4.3.364 Device_terminal_map to Part_device_terminal

Each Device_terminal_map has mapped_device_terminal defined by exactly one Part_device_terminal. Each Part_device_terminal defines mapped_device_terminal for zero, one, or more Device_terminal_map objects.

4.3.365 Device_terminal_map_relationship to Device_terminal_map

Each Device_terminal_map_relationship has related_device_terminal_map defined by exactly one Device_terminal_map. Each Device_terminal_map defines related_device_terminal_map for zero, one, or more Device_terminal_map_relationship objects.

Each Device_terminal_map_relationship has relating_device_terminal_map defined by exactly one Device_terminal_map. Each Device_terminal_map defines relating_device_terminal_map for zero, one, or more Device_terminal_map_relationship objects.

4.3.366 Diametrical_boundary_size_characteristic to Tolerance_zone_circular_or_cylindrical_or_spherical_boundary

Each Diametrical_boundary_size_characteristic has sized_boundary defined by exactly one Tolerance_zone_circular_or_cylindrical_or_spherical_boundary. Each Tolerance_zone_circular_or_cylindrical_or_spherical_boundary has size_characteristic defined by exactly one Diametrical_boundary_size_characteristic.

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4.3.367 Dielectric_crossover_area to Stratum_feature

Each Dielectric_crossover_area has related_concept defined by exactly one Stratum_feature. Each Stratum_feature defines related_concept for zero, one, or more Dielectric_crossover_area objects.

Each Dielectric_crossover_area has relating_concept defined by exactly one Stratum_feature. Each Stratum_feature defines relating_concept for zero, one, or more Dielectric_crossover_area objects.

Each Dielectric_crossover_area has resulting_dielectric_crossover defined by exactly one Stratum_feature. Each Stratum_feature defines resulting_dielectric_crossover for zero, one, or more Dielectric_crossover_area objects.

4.3.368 Dielectric_material_passage to Cutout

Each Dielectric_material_passage has precedent_passage defined by exactly one Cutout. Each Cutout defines precedent_passage for zero, one, or more Dielectric_material_passage objects.

4.3.369 Dielectric_material_passage to Ee_material

Each Dielectric_material_passage has feature_material defined by zero or one Ee_material. Each Ee_material defines feature_material for zero, one, or more Dielectric_material_passage objects. This assertion is established through material_or_specification.

4.3.370 Dielectric_material_passage to Ee_requirement_occurrence

Each Dielectric_material_passage has feature_material defined by zero or one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines feature_material for zero, one, or more Dielectric_material_passage objects. This assertion is established through material_or_specification.

4.3.371 Dimension_along_curve to Shape_element

Each Dimension_along_curve has path defined by exactly one Shape_element. Each Shape_element defines path for zero, one, or more Dimension_along_curve objects.

4.3.372 Dimension_location_with_direction_vector to Axis_placement

Each Dimension_location_with_direction_vector has measurement_direction defined by zero or one Axis_placement. Each Axis_placement defines measurement_direction for zero, one, or more Dimension_location_with_direction_vector objects. This assertion is established through axis_placement_or_datum_based_vector_orientation_select.

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4.3.373 Dimension_location_with_direction_vector to Datum_based_vector_orientation

Each Dimension_location_with_direction_vector has measurement_direction defined by zero or one Datum_based_vector_orientation. Each Datum_based_vector_orientation defines measurement_direction for zero, one, or more Dimension_location_with_direction_vector objects. This assertion is established through axis_placement_or_datum_based_vector_orientation_select.

4.3.374 Dimension_location_with_specified_datum_system to Datum_system_defining_conditions_without_material_conditions

Each Dimension_location_with_specified_datum_system has referenced_datum_system_defining_conditions defined by exactly one Datum_system_defining_conditions_without_material_conditions. Each Datum_system_defining_conditions_without_material_conditions defines referenced_datum_system_defining_conditions for zero, one, or more Dimension_location_with_specified_datum_system objects.

4.3.375 Dimension_qualifier to Dimensional_characteristic

Each Dimension_qualifier has qualified_dimensions defined by one or more Dimensional_characteristic objects. Each Dimensional_characteristic defines qualified_dimensions for zero, one, or more Dimension_qualifier objects.

4.3.376 Dimension_related_positional_boundary to Physical_feature_or_part_template

Each Dimension_related_positional_boundary has constrained_physical_feature defined by exactly one Physical_feature_or_part_template. Each Physical_feature_or_part_template defines constrained_physical_feature for zero, one, or more Dimension_related_positional_boundary objects.

4.3.377 Dimension_related_positional_boundary to Positional_boundary_member

Each Dimension_related_positional_boundary has boundary_members defined by one or more Positional_boundary_member objects. Each Positional_boundary_member has composed_positional_boundary defined by exactly one Dimension_related_positional_boundary.

4.3.378 Dimension_related_positional_boundary_definition to Dimension_related_positional_boundary

Each Dimension_related_positional_boundary_definition has defined_positional_boundary defined by exactly one Dimension_related_positional_boundary. Each Dimension_related_positional_boundary defines defined_positional_boundary for zero, one, or more Dimension_related_positional_boundary_definition objects.

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4.3.379 Dimension_related_positional_boundary_definition to Positional_boundary_member_definition

Each Dimension_related_positional_boundary_definition has characterized_boundary_member_definitions defined by one or more Positional_boundary_member_definition objects. Each Positional_boundary_member_definition has boundary_definition defined by exactly one Dimension_related_positional_boundary_definition.

4.3.380 Dimension_set to Dimensional_characteristic

Each Dimension_set has associated_dimensions defined by one or more Dimensional_characteristic objects. Each Dimensional_characteristic defines associated_dimensions for zero, one, or more Dimension_set objects.

4.3.381 Dimensional_characteristic_representation to Dimensional_location

Each Dimensional_characteristic_representation has dimension defined by zero or one Dimensional_location. Each Dimensional_location defines dimension for zero, one, or more Dimensional_characteristic_representation objects. This assertion is established through dimensional_location_or_dimensional_size.

4.3.382 Dimensional_characteristic_representation to Dimensional_size

Each Dimensional_characteristic_representation has dimension defined by zero or one Dimensional_size. Each Dimensional_size defines dimension for zero, one, or more Dimensional_characteristic_representation objects. This assertion is established through dimensional_location_or_dimensional_size.

4.3.383 Dimensional_characteristic_representation to Shape_dimension_representation

Each Dimensional_characteristic_representation has representation defined by exactly one Shape_dimension_representation. Each Shape_dimension_representation defines representation for zero, one, or more Dimensional_characteristic_representation objects.

4.3.384 Dimensional_location to Shape_element_locating_relationship

Each Dimensional_location has located_elements defined by exactly one Shape_element_locating_relationship. Each Shape_element_locating_relationship defines located_elements for zero, one, or more Dimensional_location objects.

4.3.385 Dimensional_size to Shape_element

Each Dimensional_size has size_of defined by exactly one Shape_element. Each Shape_element defines size_of for zero, one, or more Dimensional_size objects.

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4.3.386 Dimensional_size_based_on_opposing_boundaries to Composite_unit_shape_element

Each Dimensional_size_based_on_opposing_boundaries has size_of defined by exactly one Composite_unit_shape_element. Each Composite_unit_shape_element defines size_of for zero, one, or more Dimensional_size_based_on_opposing_boundaries objects.

4.3.387 Dimensional_size_based_on_opposing_boundaries to Shape_element_locating_relationship

Each Dimensional_size_based_on_opposing_boundaries has boundary_separation defined by exactly one Shape_element_locating_relationship. Each Shape_element_locating_relationship defines boundary_separation for zero, one, or more Dimensional_size_based_on_opposing_boundaries objects.

4.3.388 Directed_axis to Centre_axis

Each Directed_axis has axis_to_be_oriented defined by exactly one Centre_axis. Each Centre_axis defines axis_to_be_oriented for zero, one, or more Directed_axis objects.

4.3.389 Directed_axis to Shape_element

Each Directed_axis has end_shape_element defined by exactly one Shape_element. Each Shape_element defines end_shape_element for zero, one, or more Directed_axis objects.

Each Directed_axis has start_shape_element defined by exactly one Shape_element. Each Shape_element defines start_shape_element for zero, one, or more Directed_axis objects.

4.3.390 Direction_element to Angle_data_element

Each Direction_element has angle_value defined by exactly one Angle_data_element. Each Angle_data_element defines angle_value for zero, one, or more Direction_element objects.

4.3.391 Direction_element to Datum_based_direction_vector

Each Direction_element has direction defined by exactly one Datum_based_direction_vector. Each Datum_based_direction_vector defines direction for zero, one, or more Direction_element objects.

4.3.392 Direction_element to Datum_plane

Each Direction_element has base_datum_plane defined by exactly one Datum_plane. Each Datum_plane defines base_datum_plane for zero, one, or more Direction_element objects.

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4.3.393 Documentation_layer_stratum to Documentation_layer_technology

Each Documentation_layer_stratum has of_technology defined by exactly one Documentation_layer_-technology. Each Documentation_layer_technology defines of_technology for zero, one, or more Documentation_layer_stratum objects.

4.3.394 Ee_approval to Date

Each Ee_approval has signoff_date defined by zero or one Date. Each Date defines signoff_date for zero, one, or more Ee_approval objects. This assertion is established through date_or_date_and_time.

4.3.395 Ee_approval to Date_and_time

Each Ee_approval has signoff_date defined by zero or one Date_and_time. Each Date_and_time defines signoff_date for zero, one, or more Ee_approval objects. This assertion is established through date_or_-date_and_time.

4.3.396 Ee_approval to Ee_text

Each Ee_approval has purpose defined by exactly one Ee_text. Each Ee_text defines purpose for zero, one, or more Ee_approval objects.

4.3.397 Ee_approval to Organization

Each Ee_approval has authorizer defined by zero or more Organization objects. Each Organization defines authorizer for zero, one, or more Ee_approval objects. This assertion is established through person_organization.

4.3.398 Ee_approval to Person_and_organization

Each Ee_approval has authorizer defined by zero or more Person_and_organization objects. Each Person_and_organization defines authorizer for zero, one, or more Ee_approval objects. This assertion is established through person_organization.

4.3.399 Ee_document to Date_and_time

Each Ee_document has change_date defined by zero or more Date_and_time objects. Each Date_and_-time defines change_date for zero, one, or more Ee_document objects.

Each Ee_document has creation_date defined by exactly one Date_and_time. Each Date_and_time defines creation_date for zero, one, or more Ee_document objects.

4.3.400 Ee_document to Ee_approval

Each Ee_document has document_approval defined by zero or one Ee_approval. Each Ee_approval defines document_approval for zero, one, or more Ee_document objects.

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4.3.401 Ee_document to Ee_document_identifier

Each Ee_document has base_identifier defined by exactly one Ee_document_identifier. Each Ee_document_identifier defines base_identifier for zero, one, or more Ee_document objects.

4.3.402 Ee_document to Ee_text

Each Ee_document has text_usage defined by zero or more Ee_text objects. Each Ee_text defines text_usage for zero, one, or more Ee_document objects. This assertion is established through plain_or_structured_text.

4.3.403 Ee_document to Structured_text

Each Ee_document has key_phrase defined by zero or more structured_text objects. Each structured_text defines key_phrase for zero, one, or more Ee_document objects.

4.3.404 Ee_document to Organization

Each Ee_document has publisher defined by zero or one Organization. Each Organization defines publisher for zero, one, or more Ee_document objects. This assertion is established through person_organization.

4.3.405 Ee_document to Person

Each Ee_document has author defined by zero or more Person objects. Each Person defines author for zero, one, or more Ee_document objects.

4.3.406 Ee_document to Person_and_organization

Each Ee_document has publisher defined by zero or one Person_and_organization. Each Person_and_organization defines publisher for zero, one, or more Ee_document objects. This assertion is established through person_organization.

4.3.407 Ee_document to Security_classification

Each Ee_document has security_code defined by zero or one Security_classification. Each Security_classification defines security_code for zero, one, or more Ee_document objects.

4.3.408 Ee_document to Structured_text

Each Ee_document has text_usage defined by zero or more Structured_text objects. Each Structured_text defines text_usage for zero, one, or more Ee_document objects. This assertion is established through plain_or_structured_text.

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4.3.409 Ee_material to Coordinated_characteristic

Each Ee_material has coordinated_material_property defined by zero or more Coordinated_characteristic objects. Each Coordinated_characteristic defines coordinated_material_property for zero, one, or more Ee_material objects.

4.3.410 Ee_material to Ee_document

Each Ee_material has coordinated_material_property defined by exactly one Ee_document.

4.3.411 Ee_product to Organization

Each Ee_product has design_owner defined by zero or one Organization. Each Organization defines design_owner for zero, one, or more Ee_product objects. This assertion is established through person_organization.

4.3.412 Ee_product to Person_and_organization

Each Ee_product has design_owner defined by zero or one Person_and_organization. Each Person_and_organization defines design_owner for zero, one, or more Ee_product objects. This assertion is established through person_organization.

4.3.413 Ee_product_category to Ee_document

Each Ee_product_category has reference_document defined by zero or one Ee_document. Each Ee_document defines reference_document for zero, one, or more Ee_product_category objects.

4.3.414 Ee_product_category to Model_parameter

Each Ee_product_category has category_parameter defined by one or more Model_parameter objects. Each Model_parameter defines category_parameter for zero, one, or more Ee_product_category objects.

4.3.415 Ee_product_category to Parameter_assignment

Each Ee_product_category has category_specific_values defined by one or more Parameter_assignment objects. Each Parameter_assignment defines category_specific_values for zero, one, or more Ee_product_category objects.

4.3.416 Ee_product_category_relationship to Ee_product_category

Each Ee_product_category_relationship has category defined by exactly one Ee_product_category. Each Ee_product_category defines category for zero, one, or more Ee_product_category_relationship objects.

Each Ee_product_category_relationship has sub_category defined by exactly one Ee_product_category. Each Ee_product_category defines sub_category for zero, one, or more Ee_product_category_relationship objects.

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4.3.417 Ee_product_configuration to Ee_approval

Each Ee_product_configuration has product_configuration_approval defined by exactly one Ee_approval. Each Ee_approval defines product_configuration_approval for zero, one, or more Ee_product_configuration objects.

4.3.418 Ee_product_configuration to Ee_product_model

Each Ee_product_configuration has model_of_product defined by exactly one Ee_product_model. Each Ee_product_model defines model_of_product for zero, one, or more Ee_product_configuration objects.

4.3.419 Ee_product_configuration to Ee_product_version

Each Ee_product_configuration has satisfying_product defined by zero or more Ee_product_version objects. Each Ee_product_version defines satisfying_product for zero, one, or more Ee_product_configuration objects.

4.3.420 Ee_product_configuration to Organization

Each Ee_product_configuration has configuration_manager defined by zero or one Organization. Each Organization defines configuration_manager for zero, one, or more Ee_product_configuration objects. This assertion is established through person_organization.

4.3.421 Ee_product_configuration to Person_and_organization

Each Ee_product_configuration has configuration_manager defined by zero or one Person_and_organization. Each Person_and_organization defines configuration_manager for zero, one, or more Ee_product_configuration objects. This assertion is established through person_organization.

4.3.422 Ee_product_definition to Date_and_time

Each Ee_product_definition has creation_date defined by exactly one Date_and_time. Each Date_and_time defines creation_date for zero, one, or more Ee_product_definition objects.

4.3.423 Ee_product_definition to Ee_approval

Each Ee_product_definition has product_definition_approval defined by exactly one Ee_approval. Each Ee_approval defines product_definition_approval for zero, one, or more Ee_product_definition objects.

4.3.424 Ee_product_definition to Ee_document

Each Ee_product_definition has documentation defined by zero or more Ee_document objects. Each Ee_document defines documentation for zero, one, or more Ee_product_definition objects.

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4.3.425 Ee_product_definition to Ee_product_version

Each Ee_product_definition has version defined by exactly one Ee_product_version. Each Ee_product_-version has product_definition defined by one or more Ee_product_definition objects.

4.3.426 Ee_product_definition to Ee_text

Each Ee_product_definition has context_description defined by exactly one Ee_text. Each Ee_text defines context_description for zero, one, or more Ee_product_definition objects.

4.3.427 Ee_product_definition to Organization

Each Ee_product_definition has creator defined by zero or more Organization objects. Each Organization defines creator for zero, one, or more Ee_product_definition objects. This assertion is established through person_organization.

4.3.428 Ee_product_definition to Person_and_organization

Each Ee_product_definition has creator defined by zero or more Person_and_organization objects. Each Person_and_organization defines creator for zero, one, or more Ee_product_definition objects. This assertion is established through person_organization.

4.3.429 Ee_product_definition to Security_classification

Each Ee_product_definition has security_code defined by exactly one Security_classification. Each Security_classification defines security_code for zero, one, or more Ee_product_definition objects.

4.3.430 Ee_product_model to Ee_text

Each Ee_product_model has model_name defined by exactly one Ee_text. Each Ee_text defines model_-name for zero, one, or more Ee_product_model objects.

4.3.431 Ee_product_related_product_category to Ee_product

Each Ee_product_related_product_category has of_product defined by one or more Ee_product objects. Each Ee_product has product_classification defined by exactly one Ee_product_related_product_category.

4.3.432 Ee_product_specific_parameter_value_assignment to Ee_product

Each Ee_product_specific_parameter_value_assignment has of_product defined by exactly one Ee_product. Each Ee_product defines of_product for zero, one, or more Ee_product_specific_parameter_value_-assignment objects.

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4.3.433 Ee_product_specific_parameter_value_assignment to Ee_product_related_product_category

Each Ee_product_specific_parameter_value_assignment has associated_product_category defined by exactly one Ee_product_related_product_category. Each Ee_product_related_product_category defines associated_product_category for zero, one, or more Ee_product_specific_parameter_value_assignment objects.

4.3.434 Ee_product_specific_parameter_value_assignment to Parameter_assignment

Each Ee_product_specific_parameter_value_assignment has assigned_parameter defined by exactly one Parameter_assignment. Each Parameter_assignment defines assigned_parameter for zero, one, or more Ee_product_specific_parameter_value_assignment objects.

4.3.435 Ee_product_version to Contract

Each Ee_product_version has authorizing_agreement defined by zero or one Contract. Each Contract defines authorizing_agreement for zero, one, or more Ee_product_version objects.

4.3.436 Ee_product_version to Ee_approval

Each Ee_product_version has product_version_approval defined by exactly one Ee_approval. Each Ee_approval defines product_version_approval for zero, one, or more Ee_product_version objects.

4.3.437 Ee_product_version to Ee_product

Each Ee_product_version has versioned_item defined by exactly one Ee_product. Each Ee_product has product_version defined by one or more Ee_product_version objects.

4.3.438 Ee_product_version to Organization

Each Ee_product_version has creator defined by zero or one Organization. Each Organization defines creator for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

Each Ee_product_version has design_supplier defined by zero or one Organization. Each Organization defines design_supplier for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

Each Ee_product_version has product_supplier defined by zero or one Organization. Each Organization defines product_supplier for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

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4.3.439 Ee_product_version to Person_and_organization

Each Ee_product_version has creator defined by zero or one Person_and_organization. Each Person_and_organization defines creator for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

Each Ee_product_version has design_supplier defined by zero or one Person_and_organization. Each Person_and_organization defines design_supplier for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

Each Ee_product_version has product_supplier defined by zero or one Person_and_organization. Each Person_and_organization defines product_supplier for zero, one, or more Ee_product_version objects. This assertion is established through person_organization.

4.3.440 Ee_product_version to Security_classification

Each Ee_product_version has security_code defined by exactly one Security_classification. Each Security_classification defines security_code for zero, one, or more Ee_product_version objects.

4.3.441 Ee_requirement_occurrence to Analytical_representative

Each Ee_requirement_occurrence has required_analytical_representation defined by zero or more Analytical_representative objects.

4.3.442 Ee_requirement_occurrence to Characteristic

Each Ee_requirement_occurrence has required_characteristic defined by zero or more Characteristic objects. Each Characteristic defines required_characteristic for zero, one, or more Ee_requirement_occurrence objects.

4.3.443 Ee_requirement_occurrence to Coordinated_characteristic

Each Ee_requirement_occurrence has required_coordinated_characteristic defined by zero or more Coordinated_characteristic objects. Each Coordinated_characteristic defines required_coordinated_characteristic for zero, one, or more Ee_requirement_occurrence objects.

4.3.444 Ee_requirement_occurrence to Ee_material

Each Ee_requirement_occurrence has required_material defined by zero or one Ee_material. Each Ee_material defines required_material for zero, one, or more Ee_requirement_occurrence objects.

4.3.445 Ee_requirement_occurrence to Ee_product

Each Ee_requirement_occurrence has required_part defined by zero or more Ee_product objects. Each Ee_product defines required_part for zero, one, or more Ee_requirement_occurrence objects.

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4.3.446 Ee_requirement_occurrence to Ee_specification

Each Ee_requirement_occurrence has required_specification defined by zero or more Ee_specification objects. Each Ee_specification defines required_specification for zero, one, or more Ee_requirement_-occurrence objects.

Each Ee_requirement_occurrence has requirement_specification defined by one or more Ee_specification objects. Each Ee_specification defines requirement_specification for zero, one, or more Ee_requirement_occurrence objects.

4.3.447 Ee_requirement_occurrence to Ee_text

Each Ee_requirement_occurrence has description defined by zero or one Ee_text. Each Ee_text defines description for zero, one, or more Ee_requirement_occurrence objects.

4.3.448 Ee_rule_definition to Ee_rule_function

Each Ee_rule_definition has rule_definition_conclusion defined by exactly one Ee_rule_function. Each Ee_rule_function defines rule_definition_conclusion for zero, one, or more Ee_rule_definition objects.

Each Ee_rule_definition has rule_definition_premise defined by exactly one Ee_rule_function. Each Ee_rule_function defines rule_definition_premise for zero, one, or more Ee_rule_definition objects.

4.3.449 Ee_rule_definition to Ee_rule_version

Each Ee_rule_definition has defined_versioned_rule defined by exactly one Ee_rule_version. Each Ee_-rule_version defines defined_versioned_rule for zero, one, or more Ee_rule_definition objects.

4.3.450 Ee_rule_function to Model_parameter

Each Ee_rule_function has parameter defined by one or more Model_parameter objects.

4.3.451 Ee_rule_function to Ee_document

Each Ee_rule_function has reference_document defined by exactly one Ee_document.

4.3.452 Ee_rule_function to Ee_specification

Each Ee_rule_function has source_code defined by exactly one Ee_specification.

4.3.453 Ee_rule_version to Ee_document

Each Ee_rule_version has source defined by zero or one Ee_document. Each Ee_document defines source for zero, one, or more Ee_rule_version objects. This assertion is established through document_-or_organization.

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4.3.454 Ee_rule_version to Ee_rule

Each Ee_rule_version has configuration_managed_rule defined by exactly one Ee_rule. Each Ee_rule has version defined by one or more Ee_rule_version objects.

4.3.455 Ee_rule_version to Organization

Each Ee_rule_version has source defined by zero or one Organization. Each Organization defines source for zero, one, or more Ee_rule_version objects. This assertion is established through document_or_organization.

4.3.456 Ee_specification to Organization

Each Ee_specification has source defined by zero or one Organization. Each Organization defines source for zero, one, or more Ee_specification objects. This assertion is established through person_organization.

4.3.457 Ee_specification to Person_and_organization

Each Ee_specification has source defined by zero or one Person_and_organization. Each Person_and_organization defines source for zero, one, or more Ee_specification objects. This assertion is established through person_organization.

4.3.458 Electrical_isolation_removal_structure to Ee_requirement_occurrence

Each Electrical_isolation_removal_structure has electrical_isolation_spacing_requirement defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines electrical_isolation_spacing_requirement for zero, one, or more Electrical_isolation_removal_structure objects.

4.3.459 Engineering_make_from to Ee_product_definition

Each Engineering_make_from has base_design defined by exactly one Ee_product_definition. Each Ee_product_definition defines base_design for zero, one, or more Engineering_make_from objects.

Each Engineering_make_from has resultant_design defined by exactly one Ee_product_definition. Each Ee_product_definition defines resultant_design for zero, one, or more Engineering_make_from objects.

4.3.460 Equivalent_functional_terminals_assignment to Functional_unit_usage_view_terminal_definition

Each Equivalent_functional_terminals_assignment has equivalent_terminals defined by two or more Functional_unit_usage_view_terminal_definition objects. Each Functional_unit_usage_view_terminal_definition defines equivalent_terminals for zero, one, or more Equivalent_functional_terminals_assignment objects.

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4.3.461 Equivalent_functional_unit_definition_assignment to Functional_unit_definition

Each Equivalent_functional_unit_definition_assignment has equivalent_functional_unit_definitions defined by two or more Functional_unit_definition objects. Each Functional_unit_definition defines equivalent_functional_unit_definitions for zero, one, or more Equivalent_functional_unit_definition_assignment objects.

4.3.462 Evaluated_characteristic to Coordinated_characteristic

Each Evaluated_characteristic has product_characterization_data defined by zero or more Coordinated_characteristic objects. Each Coordinated_characteristic defines product_characterization_data for zero, one, or more Evaluated_characteristic objects.

4.3.463 Evaluated_characteristic to Planned_characteristic

Each Evaluated_characteristic has evaluated_product_data defined by exactly one Planned_characteristic. Each Planned_characteristic defines evaluated_product_data for zero, one, or more Evaluated_characteristic objects.

4.3.464 Explicitly_located_layer_connection_point to Cartesian_point

Each Explicitly_located_layer_connection_point has location defined by exactly one Cartesian_point. Each Cartesian_point defines location for zero, one, or more Explicitly_located_layer_connection_point objects.

4.3.465 External_definition to Ee_document

Each External_definition has reference_document defined by zero or one Ee_document. Each Ee_document defines reference_document for zero, one, or more External_definition objects. This assertion is established through standard_or_reference_document.

4.3.466 External_definition to Standard_document_identification_string

Each External_definition has reference_document defined by zero or one standard_document_identification_string. Each standard_document_identification_string defines reference_document for zero, one, or more External_definition objects. This assertion is established through standard_or_reference_document.

4.3.467 Externally_defined_dimension_representation to Data_element

Each Externally_defined_dimension_representation has dimension_value defined by zero or one Data_element. Each Data_element defines dimension_value for zero, one, or more Externally_defined_dimension_representation objects.

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4.3.468 Externally_defined_dimension_representation to External_definition

Each Externally_defined_dimension_representation has definitions defined by one or more External_definition. Each External_definition defines definitions for zero, one, or more Externally_defined_dimension_representation objects.

4.3.469 Fabrication_joint to Component_termination_passage_join_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Component_termination_passage_join_terminal objects. Each Component_termination_passage_join_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.470 Fabrication_joint to Conductive_interconnect_element_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Conductive_interconnect_element_terminal objects. Each Conductive_interconnect_element_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.471 Fabrication_joint to Land_join_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Land_join_terminal objects. Each Land_join_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.472 Fabrication_joint to Non_functional_land_join_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Non_functional_land_join_terminal objects. Each Non_functional_land_join_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.473 Fabrication_joint to Printed_component_join_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Printed_component_join_terminal objects. Each Printed_component_join_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.474 Fabrication_joint to Stratum_feature_template_component

Each Fabrication_joint has auxiliary_joint_material defined by zero or one Stratum_feature_template_component. Each Stratum_feature_template_component defines auxiliary_joint_material for zero, one, or more Fabrication_joint objects.

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4.3.475 Fabrication_joint to Via_terminal

Each Fabrication_joint has fabrication_features defined by zero, one, or two Via_terminal objects. Each Via_terminal defines fabrication_features for zero, one, or more Fabrication_joint objects. This assertion is established through fabricated_feature_select.

4.3.476 Feature_group_relationship to Part_feature

Each Feature_group_relationship has related_feature defined by one or more Part_feature objects. Each Part_feature defines related_feature for zero, one, or more Feature_group_relationship objects.

4.3.477 Feature_group_relationship to Part_group_feature

Each Feature_group_relationship has relating_feature defined by exactly one Part_group_feature. Each Part_group_feature defines relating_feature for zero, one, or more Feature_group_relationship objects.

4.3.478 Feature_shape_composition_relationship to Axis_placement

Each Feature_shape_composition_relationship has related_feature_shape_placement defined by exactly one Axis_placement. Each Axis_placement defines related_feature_shape_placement for zero, one, or more Feature_shape_composition_relationship objects.

4.3.479 Feature_shape_composition_relationship to Feature_shape_definition

Each Feature_shape_composition_relationship has resultant_feature_shape defined by exactly one Feature_shape_definition. Each Feature_shape_definition defines resultant_feature_shape for zero, one, or more Feature_shape_composition_relationship objects.

4.3.480 Feature_shape_composition_relationship to Feature_shape_occurrence

Each Feature_shape_composition_relationship has related_feature_shape defined by exactly one Feature_shape_occurrence. Each Feature_shape_occurrence defines related_feature_shape for zero, one, or more Feature_shape_composition_relationship objects.

4.3.481 Feature_shape_definition to Cartesian_coordinate_system

Each Feature_shape_definition has geometric_context defined by exactly one Cartesian_coordinate_system. Each Cartesian_coordinate_system defines geometric_context for zero, one, or more Feature_shape_definition objects.

4.3.482 Feature_shape_occurrence to Feature_shape_definition

Each Feature_shape_occurrence has instantiated_feature_shape defined by exactly one Feature_shape_definition. Each Feature_shape_definition defines instantiated_feature_shape for zero, one, or more Feature_shape_occurrence objects.

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4.3.483 Fill_area to Curve

Each Fill_area has boundary defined by one or more Curve objects. Each Curve defines boundary for zero, one, or more Fill_area objects.

4.3.484 Fill_area_occurrence to Cartesian_point

Each Fill_area_occurrence has fill_style_target defined by exactly one Cartesian_point. Each Cartesian_point defines fill_style_target for zero, one, or more Fill_area_occurrence objects.

4.3.485 Fill_area_occurrence to Curve_style

Each Fill_area_occurrence has boundary_style defined by exactly one Curve_style. Each Curve_style defines boundary_style for zero, one, or more Fill_area_occurrence objects.

4.3.486 Fill_area_occurrence to Fill_area

Each Fill_area_occurrence has filled_area defined by exactly one Fill_area. Each Fill_area defines filled_area for zero, one, or more Fill_area_occurrence objects.

4.3.487 Fill_area_occurrence to Fill_area_style

Each Fill_area_occurrence has style defined by one or more Fill_area_style objects. Each Fill_area_style defines style for zero, one, or more Fill_area_occurrence objects.

4.3.488 Fill_area_style to Externally_defined_hatch_style

Each Fill_area_style has fill_style defined by zero or more Externally_defined_hatch_style objects. Each Externally_defined_hatch_style defines fill_style for zero, one, or more Fill_area_style objects. This assertion is established through fill_style_select.

4.3.489 Fill_area_style to Externally_defined_tile_style

Each Fill_area_style has fill_style defined by zero or more Externally_defined_tile_style objects. Each Externally_defined_tile_style defines fill_style for zero, one, or more Fill_area_style objects. This assertion is established through fill_style_select.

4.3.490 Fill_area_style to Fill_area_style_hatching

Each Fill_area_style has fill_style defined by zero or more Fill_area_style_hatching objects. Each Fill_area_style_hatching defines fill_style for zero, one, or more Fill_area_style objects. This assertion is established through fill_style_select.

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4.3.491 Fill_area_style to Fill_area_style_tile

Each Fill_area_style has fill_style defined by zero or more Fill_area_style_tile objects. Each Fill_area_style_tile defines fill_style for zero, one, or more Fill_area_style objects. This assertion is established through fill_style_select.

4.3.492 Fill_area_style to Solid_fill_style

Each Fill_area_style has fill_style defined by zero or more Solid_fill_style objects. Each Solid_fill_style defines fill_style for zero, one, or more Fill_area_style objects. This assertion is established through fill_style_select.

4.3.493 Fill_area_style_hatching to Angle_data_element

Each Fill_area_style_hatching has hatch_line_angle defined by exactly one Angle_data_element. Each Angle_data_element defines hatch_line_angle for zero, one, or more Fill_area_style_hatching objects.

4.3.494 Fill_area_style_hatching to Cartesian_point

Each Fill_area_style_hatching has pattern_start defined by exactly one Cartesian_point. Each Cartesian_point defines pattern_start for zero, one, or more Fill_area_style_hatching objects.

Each Fill_area_style_hatching has point_of_reference_hatch_line defined by exactly one Cartesian_point. Each Cartesian_point defines point_of_reference_hatch_line for zero, one, or more Fill_area_style_hatching objects.

4.3.495 Fill_area_style_hatching to Curve_style

Each Fill_area_style_hatching has hatch_line_appearance defined by exactly one Curve_style. Each Curve_style defines hatch_line_appearance for zero, one, or more Fill_area_style_hatching objects.

4.3.496 Fill_area_style_hatching to Vector

Each Fill_area_style_hatching has start_of_next_hatch_line defined by exactly one Vector. Each Vector defines start_of_next_hatch_line for zero, one, or more Fill_area_style_hatching objects.

4.3.497 Fill_area_style_tile to Externally_defined_tile

Each Fill_area_style_tile has tile defined by zero or more Externally_defined_tile objects. Each Externally_defined_tile defines tile for zero, one, or more Fill_area_style_tile objects. This assertion is established through fill_area_style_tile_shape_select.

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4.3.498 Fill_area_style_tile to Fill_area_style_tile_curve_with_style

Each Fill_area_style_tile has tile defined by zero or more Fill_area_style_tile_curve_with_style objects. Each Fill_area_style_tile_curve_with_style defines tile for zero, one, or more Fill_area_style_tile objects. This assertion is established through fill_area_style_tile_shape_select.

4.3.499 Fill_area_style_tile to Fill_area_style_tile_solid_region

Each Fill_area_style_tile has tile defined by zero or more Fill_area_style_tile_solid_region objects. Each Fill_area_style_tile_solid_region defines tile for zero, one, or more Fill_area_style_tile objects. This assertion is established through fill_area_style_tile_shape_select.

4.3.500 Fill_area_style_tile to Fill_area_style_tile_symbol_with_style

Each Fill_area_style_tile has tile defined by zero or more Fill_area_style_tile_symbol_with_style objects. Each Fill_area_style_tile_symbol_with_style defines tile for zero, one, or more Fill_area_style_tile objects. This assertion is established through fill_area_style_tile_shape_select.

4.3.501 Fill_area_style_tile to Positive_ratio_measure

Each Fill_area_style_tile has tiling_scale defined by exactly one Positive_ratio_measure. Each Positive_ratio_measure defines tiling_scale for zero, one, or more Fill_area_style_tile objects.

4.3.502 Fill_area_style_tile to Vector

Each Fill_area_style_tile has tiling_pattern defined by exactly two Vector objects. Each Vector defines tiling_pattern for zero, one, or more Fill_area_style_tile objects.

4.3.503 Filled_area_material_removal_structure to Conductive_filled_area

Each Filled_area_material_removal_structure has design_intent defined by exactly one Conductive_filled_area. Each Conductive_filled_area defines design_intent for zero, one, or more Filled_area_material_removal_structure objects.

4.3.504 Frozen_assignment to Ee_approval

Each Frozen_assignment has assigned_approval defined by exactly one Ee_approval. Each Ee_approval defines assigned_approval for zero, one, or more Frozen_assignment objects.

4.3.505 Frozen_assignment to Frozen_design_object

Each Frozen_assignment has frozen_item defined by one or more Frozen_design_object objects. Each Frozen_design_object defines frozen_item for zero, one, or more Frozen_assignment objects.

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4.3.506 Functional_specification to External_definition

Each Functional_specification has characteristic_category defined by exactly one External_definition. Each External_definition defines characteristic_category for zero, one, or more Functional_specification objects.

4.3.507 Functional_specification to Signal_specification

Each Functional_specification has characterizing_signal defined by exactly one Signal_specification. Each Signal_specification defines characterizing_signal for zero, one, or more Functional_specification objects.

Each Functional_specification has reference_signal defined by exactly one Signal_specification. Each Signal_specification defines reference_signal for zero, one, or more Functional_specification objects.

4.3.508 Functional_specification_to_requirement_occurrence_assignment to Ee_requirement_occurrence

Each Functional_specification_to_requirement_occurrence_assignment has assigned_requirement_occurrence defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines assigned_requirement_occurrence for zero, one, or more Functional_specification_to_requirement_occurrence_assignment objects.

4.3.509 Functional_terminal_group_assignment to Functional_terminal_group

Each Functional_terminal_group_assignment has composed_group defined by exactly one Functional_terminal_group.

4.3.510 Functional_terminal_group_assignment to Scalar_terminal_definition

Each Functional_terminal_group_assignment has functional_usage_view_terminal defined by exactly one Scalar_terminal_definition.

4.3.511 Functional_unit to Characteristic

Each Functional_unit has functional_property defined by zero or more Characteristic objects. Each Characteristic defines functional_property for zero, one, or more Functional_unit objects.

4.3.512 Functional_unit to Functional_unit_definition

Each Functional_unit has definition defined by exactly one Functional_unit_definition. Each Functional_unit_definition defines definition for zero, one, or more Functional_unit objects.

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4.3.513 Functional_unit to Functional_unit_network_definition

Each Functional_unit has composed_network defined by exactly one Functional_unit_network_definition. Each Functional_unit_network_definition defines composed_network for zero, one, or more Functional_unit objects.

4.3.514 Functional_unit_definition to Analytical_representation

Each Functional_unit_definition has analytical_functional_unit_representation defined by zero or more Analytical_representation objects. Each Analytical_representation defines analytical_functional_unit_representation for zero, one, or more Functional_unit_definition objects.

4.3.515 Functional_unit_network_definition to Functional_unit_usage_view

Each Functional_unit_network_definition has usage_view defined by exactly one Functional_unit_usage_view. Each Functional_unit_usage_view defines usage_view for zero, one, or more Functional_unit_network_definition objects.

4.3.516 Functional_unit_network_node_definition to Functional_unit_network_definition

Each Functional_unit_network_node_definition has associated_functional_unit_definition defined by exactly one Functional_unit_network_definition. Each Functional_unit_network_definition defines associated_functional_unit_definition for zero, one, or more Functional_unit_network_node_definition objects.

4.3.517 Functional_unit_network_terminal_definition_bus_assignment to Bus_structural_definition

Each Functional_unit_network_terminal_definition_bus_assignment has connected_bus defined by exactly one Bus_structural_definition. Each Bus_structural_definition has external_bus_access defined by zero or one Functional_unit_network_terminal_definition_bus_assignment.

4.3.518 Functional_unit_network_terminal_definition_bus_assignment to Functional_unit_usage_view_terminal_definition

Each Functional_unit_network_terminal_definition_bus_assignment has connected_terminal defined by exactly one Functional_unit_usage_view_terminal_definition. Each Functional_unit_usage_view_terminal_definition has bus_assignment defined by zero or one Functional_unit_network_terminal_definition_bus_assignment.

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4.3.519 Functional_unit_network_terminal_definition_node_assignment to Functional_unit_network_node_definition

Each Functional_unit_network_terminal_definition_node_assignment has composed_node defined by exactly one Functional_unit_network_node_definition. Each Functional_unit_network_node_definition has external_node_access defined by zero or one Functional_unit_network_terminal_definition_node_-assignment.

4.3.520 Functional_unit_network_terminal_definition_node_assignment to Functional_unit_usage_view_terminal_definition

Each Functional_unit_network_terminal_definition_node_assignment has connected_terminal defined by exactly one Functional_unit_usage_view_terminal_definition. Each Functional_unit_usage_view_-terminal_definition has node_assignment defined by zero or one Functional_unit_network_terminal_-definition_node_assignment.

4.3.521 Functional_unit_requirement_allocation to Ee_requirement_occurrence

Each Functional_unit_requirement_allocation has functional_requirement defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines functional_requirement for zero, one, or more Functional_unit_requirement_allocation objects.

4.3.522 Functional_unit_requirement_allocation to Functional_unit

Each Functional_unit_requirement_allocation has functional_unit_assignment defined by exactly one Functional_unit. Each Functional_unit defines functional_unit_assignment for zero, one, or more Functional_unit_requirement_allocation objects.

4.3.523 Functional_unit_terminal to Functional_unit

Each Functional_unit_terminal has accessed_functional_unit defined by exactly one Functional_unit. Each Functional_unit has access_mechanisms defined by one or more Functional_unit_terminal objects.

4.3.524 Functional_unit_terminal to Functional_unit_usage_view_terminal_definition

Each Functional_unit_terminal has definition defined by exactly one Functional_unit_usage_view_terminal_definition. Each Functional_unit_usage_view_terminal_definition defines definition for zero, one, or more Functional_unit_terminal objects.

4.3.525 Functional_unit_terminal_bus_assignment to Bus_structural_definition

Each Functional_unit_terminal_bus_assignment has connected_bus defined by exactly one Bus_structural_definition. Each Bus_structural_definition defines connected_bus for zero, one, or more Functional_unit_terminal_bus_assignment objects.

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4.3.526 Functional_unit_terminal_bus_assignment to Functional_unit_terminal

Each Functional_unit_terminal_bus_assignment has connected_terminal defined by exactly one Functional_unit_terminal. Each Functional_unit_terminal has bus_assignment defined by zero or one Functional_unit_terminal_bus_assignment.

4.3.527 Functional_unit_terminal_node_assignment to Functional_unit_network_node_definition

Each Functional_unit_terminal_node_assignment has composed_node defined by exactly one Functional_unit_network_node_definition. Each Functional_unit_network_node_definition defines composed_node for zero, one, or more Functional_unit_terminal_node_assignment objects.

4.3.528 Functional_unit_terminal_node_assignment to Functional_unit_terminal

Each Functional_unit_terminal_node_assignment has connected_terminal defined by exactly one Functional_unit_terminal. Each Functional_unit_terminal has node_assignment defined by zero or one Functional_unit_terminal_node_assignment.

4.3.529 Functional_unit_usage_view_terminal_definition to Functional_unit_usage_view

Each Functional_unit_usage_view_terminal_definition has associated_functional_unit_definition defined by exactly one Functional_unit_usage_view. Each Functional_unit_usage_view has access_mechanism defined by one or more Functional_unit_usage_view_terminal_definition objects.

4.3.530 Functional_usage_view_to_part_terminal_assignment to Part_terminal

Each Functional_usage_view_to_part_terminal_assignment has physical_usage_view_terminal defined by exactly one Part_terminal. Each Part_terminal has functional_usage_view_terminal defined by zero or one Functional_usage_view_to_part_terminal_assignment.

4.3.531 Functional_usage_view_to_part_terminal_assignment to Scalar_terminal_definition

Each Functional_usage_view_to_part_terminal_assignment has functional_usage_view_terminal defined by exactly one Scalar_terminal_definition. Each Scalar_terminal_definition defines functional_usage_view_terminal for zero, one, or more Functional_usage_view_to_part_terminal_assignment objects.

4.3.532 Functional_usage_view_to_printed_part_template_terminal_assignment to Printed_part_template_terminal

Each Functional_usage_view_to_printed_part_template_terminal_assignment has physical_usage_view_terminal defined by exactly one Printed_part_template_terminal. Each Printed_part_template_terminal has functional_usage_view_terminal defined by zero or one Functional_usage_view_to_printed_part_template_terminal_assignment.

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4.3.533 Functional_usage_view_to_printed_part_template_terminal_assignment to Scalar_terminal_definition

Each Functional_usage_view_to_printed_part_template_terminal_assignment has functional_usage_view_terminal defined by exactly one Scalar_terminal_definition. Each Scalar_terminal_definition defines functional_usage_view_terminal for zero, one, or more Functional_usage_view_to_printed_part_template_terminal_assignment objects.

4.3.534 Gate_path_swap_specification to Design_functional_unit_allocation_to_reference_functional_unit

Each Gate_path_swap_specification has current_design_object defined by exactly one Design_functional_unit_allocation_to_reference_functional_unit. Each Design_functional_unit_allocation_to_reference_functional_unit defines current_design_object for zero, one, or more Gate_path_swap_specification objects.

Each Gate_path_swap_specification has previous_design_object defined by exactly one Design_functional_unit_allocation_to_reference_functional_unit. Each Design_functional_unit_allocation_to_reference_functional_unit defines previous_design_object for zero, one, or more Gate_path_swap_specification objects.

4.3.535 Geometric_tolerance to Centre_axis

Each Geometric_tolerance has toleranced_shape_element defined by zero or one Centre_axis. Each Centre_axis defines toleranced_shape_element for zero, one, or more Geometric_tolerance objects. This assertion is established through toleranceable_shape_element.

4.3.536 Geometric_tolerance to Centre_plane

Each Geometric_tolerance has toleranced_shape_element defined by zero or one Centre_plane. Each Centre_plane defines toleranced_shape_element for zero, one, or more Geometric_tolerance objects. This assertion is established through toleranceable_shape_element.

4.3.537 Geometric_tolerance to Centre_point

Each Geometric_tolerance has toleranced_shape_element defined by zero or one Centre_point. Each Centre_point defines toleranced_shape_element for zero, one, or more Geometric_tolerance objects. This assertion is established through toleranceable_shape_element.

4.3.538 Geometric_tolerance to Conical_tolerance_zone_boundary_diametrical_size_characteristic

Each Geometric_tolerance has tolerance_zone_or_boundary_definition defined by zero or one Conical_tolerance_zone_boundary_diametrical_size_characteristic. Each Conical_tolerance_zone_boundary_diametrical_size_characteristic defines tolerance_zone_or_boundary_definition for zero, one, or more Geometric_tolerance objects. This assertion is established through constraining_element_definitions.

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4.3.539 Geometric_tolerance to Physical_feature_or_part_template

Each Geometric_tolerance has toleranced_shape_element defined by zero or one Physical_feature_or_part_template. Each Physical_feature_or_part_template defines toleranced_shape_element for zero, one, or more Geometric_tolerance objects. This assertion is established through toleranceable_shape_element.

4.3.540 Geometric_tolerance to Positional_boundary_member_definition

Each Geometric_tolerance has tolerance_zone_or_boundary_definition defined by zero or one Positional_boundary_member_definition. Each Positional_boundary_member_definition defines tolerance_zone_or_boundary_definition for zero, one, or more Geometric_tolerance objects. This assertion is established through constraining_element_definitions.

4.3.541 Geometric_tolerance to Profile_related_positional_boundary_definition

Each Geometric_tolerance has tolerance_zone_or_boundary_definition defined by zero or one Profile_related_positional_boundary_definition. Each Profile_related_positional_boundary_definition defines tolerance_zone_or_boundary_definition for zero, one, or more Geometric_tolerance objects. This assertion is established through constraining_element_definitions.

4.3.542 Geometric_tolerance to Tangent_plane

Each Geometric_tolerance has toleranced_shape_element defined by zero or one Tangent_plane. Each Tangent_plane defines toleranced_shape_element for zero, one, or more Geometric_tolerance objects. This assertion is established through toleranceable_shape_element.

4.3.543 Geometric_tolerance to Tolerance_zone_definition

Each Geometric_tolerance has tolerance_zone_or_boundary_definition defined by zero or one Tolerance_zone_definition. Each Tolerance_zone_definition defines tolerance_zone_or_boundary_definition for zero, one, or more Geometric_tolerance objects. This assertion is established through constraining_element_definitions.

4.3.544 Geometric_tolerance_qualifier to Geometric_tolerance

Each Geometric_tolerance_qualifier has qualified_geometric_tolerances defined by one or more Geometric_tolerance objects. Each Geometric_tolerance defines qualified_geometric_tolerances for zero, one, or more Geometric_tolerance_qualifier objects.

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4.3.545 Geometric_tolerance_with_referenced_datum_system to Datum_system_defining_conditions

Each Geometric_tolerance_with_referenced_datum_system has datum_system_definition defined by exactly one Datum_system_defining_conditions. Each Datum_system_defining_conditions defines datum_system_definition for zero, one, or more Geometric_tolerance_with_referenced_datum_system objects.

4.3.546 Inter_stratum_extent to Stratum

Each Inter_stratum_extent has from_stratum defined by exactly one Stratum. Each Stratum defines from_stratum for zero, one, or more Inter_stratum_extent objects.

Each Inter_stratum_extent has to_stratum defined by exactly one Stratum. Each Stratum defines to_stratum for zero, one, or more Inter_stratum_extent objects.

4.3.547 Inter_stratum_feature to Inter_stratum_feature_template

Each Inter_stratum_feature has usage_definition defined by exactly one Inter_stratum_feature_template. Each Inter_stratum_feature_template defines usage_definition for zero, one, or more Inter_stratum_feature objects.

4.3.548 Inter_stratum_feature_template to Passage_technology

Each Inter_stratum_feature_template has of_passage_technology defined by exactly one Passage_technology. Each Passage_technology defines of_passage_technology for zero, one, or more Inter_stratum_feature_template objects.

4.3.549 Inter_stratum_join_implementation to Inter_stratum_join_relationship

Each Inter_stratum_join_implementation has topological_requirement defined by exactly one Inter_stratum_join_relationship. Each Inter_stratum_join_relationship defines topological_requirement for zero, one, or more Inter_stratum_join_implementation objects.

4.3.550 Interconnect_component_interface_terminal to Connection_zone

Each Interconnect_component_interface_terminal has connection defined by exactly one Connection_zone. Each Connection_zone defines connection for zero, one, or more Interconnect_component_interface_terminal objects.

4.3.551 Interconnect_component_join_terminal to Connection_zone

Each Interconnect_component_join_terminal has connection defined by exactly one Connection_zone. Each Connection_zone defines connection for zero, one, or more Interconnect_component_join_terminal objects.

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4.3.552 Interconnect_module_component to Interconnect_module_usage_view

Each Interconnect_module_component has usage_definition defined by exactly one Interconnect_module_usage_view. Each Interconnect_module_usage_view defines usage_definition for zero, one, or more Interconnect_module_component objects.

4.3.553 Interconnect_module_component_stratum_based_terminal to Interconnect_module_stratum_based_terminal

Each Interconnect_module_component_stratum_based_terminal has definition defined by exactly one Interconnect_module_stratum_based_terminal. Each Interconnect_module_stratum_based_terminal defines definition for zero, one, or more Interconnect_module_component_stratum_based_terminal objects.

4.3.554 Interconnect_module_component_terminal to Interconnect_module_component

Each Interconnect_module_component_terminal has associated_component defined by exactly one Interconnect_module_component. Each Interconnect_module_component has access_mechanisms defined by two or more Interconnect_module_component_terminal objects.

4.3.555 Interconnect_module_component_terminal to Interconnect_module_terminal

Each Interconnect_module_component_terminal has definition defined by exactly one Interconnect_module_terminal. Each Interconnect_module_terminal defines definition for zero, one, or more Interconnect_module_component_terminal objects.

4.3.556 Interconnect_module_constraint_region to Component_termination_passage

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Component_termination_passage objects. Each Component_termination_passage defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.557 Interconnect_module_constraint_region to Conductive_filled_area

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Conductive_filled_area objects. Each Conductive_filled_area defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

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4.3.558 Interconnect_module_constraint_region to Conductor

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Conductor objects. Each Conductor defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.559 Interconnect_module_constraint_region to Cutout

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Cutout objects. Each Cutout defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.560 Interconnect_module_constraint_region to Ee_requirement_occurrence

Each Interconnect_module_constraint_region has requirement defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines requirement for zero, one, or more Interconnect_module_constraint_region objects.

4.3.561 Interconnect_module_constraint_region to Feature_shape_occurrence

Each Interconnect_module_constraint_region has area defined by exactly one Feature_shape_occurrence. Each Feature_shape_occurrence defines area for zero, one, or more Interconnect_module_constraint_region objects.

4.3.562 Interconnect_module_constraint_region to Inter_stratum_extent

Each Interconnect_module_constraint_region has associated_stratum_extent defined by one or more Inter_stratum_extent objects. Each Inter_stratum_extent defines associated_stratum_extent for zero, one, or more Interconnect_module_constraint_region objects.

4.3.563 Interconnect_module_constraint_region to Inter_stratum_feature

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Inter_stratum_feature objects. Each Inter_stratum_feature defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.564 Interconnect_module_constraint_region to Interconnect_module

Each Interconnect_module_constraint_region has scope defined by one or more Interconnect_module objects. Each Interconnect_module defines scope for zero, one, or more Interconnect_module_constraint_region objects.

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4.3.565 Interconnect_module_constraint_region to Laminate_component

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Laminate_component objects. Each Laminate_component defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.566 Interconnect_module_constraint_region to Land

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Land objects. Each Land defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.567 Interconnect_module_constraint_region to Non_functional_land

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Non_functional_land objects. Each Non_functional_land defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.568 Interconnect_module_constraint_region to Stratum_feature

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Stratum_feature objects. Each Stratum_feature defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.569 Interconnect_module_constraint_region to Via

Each Interconnect_module_constraint_region has non_conformant_interconnect_module_design_object defined by zero or more Via objects. Each Via defines non_conformant_interconnect_module_design_object for zero, one, or more Interconnect_module_constraint_region objects. This assertion is established through interconnect_module_design_object_select.

4.3.570 Interconnect_module_edge_segment to Interconnect_module_edge

Each Interconnect_module_edge_segment has composed_edge defined by exactly one Interconnect_module_edge. Each Interconnect_module_edge defines composed_edge for zero, one, or more Interconnect_module_edge_segment objects.

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4.3.571 Interconnect_module_product_assembly_view_fabrication_joint to Interconnect_module_component_stratum_based_terminal

Each Interconnect_module_product_assembly_view_fabrication_joint has joined_terminal defined by one or more Interconnect_module_component_stratum_based_terminal objects. Each Interconnect_module_component_stratum_based_terminal defines joined_terminal for zero, one, or more Interconnect_module_product_assembly_view_fabrication_joint objects.

4.3.572 Interconnect_module_product_assembly_view_fabrication_joint to Plated_inter_stratum_feature

Each Interconnect_module_product_assembly_view_fabrication_joint has joint_implementation defined by exactly one Plated_inter_stratum_feature. Each Plated_inter_stratum_feature defines joint_implementation for zero, one, or more Interconnect_module_product_assembly_view_fabrication_joint objects.

4.3.573 Interconnect_module_stratum_assembly_relationship to Interconnect_module

Each Interconnect_module_stratum_assembly_relationship has assembly defined by exactly one Interconnect_module. Each Interconnect_module defines assembly for zero, one, or more Interconnect_module_stratum_assembly_relationship objects.

4.3.574 Interconnect_module_stratum_assembly_relationship to Stratum

Each Interconnect_module_stratum_assembly_relationship has component defined by exactly one Stratum. Each Stratum has assembly defined by one or more Interconnect_module_stratum_assembly_relationship objects.

4.3.575 Interconnect_module_terminal to Connection_zone

Each Interconnect_module_terminal has terminal_connection_zone defined by one or more Connection_zone objects. Each Connection_zone defines terminal_connection_zone for one, or more Interconnect_module_terminal objects.

4.3.576 Interconnect_module_terminal to Feature_shape_occurrence

Each Interconnect_module_terminal has feature_shape defined by one or more Feature_shape_occurrence objects. Each Feature_shape_occurrence defines feature_shape for zero, one, or more Interconnect_module_terminal objects.

4.3.577 Interconnect_module_terminal to Interconnect_module_usage_view

Each Interconnect_module_terminal has associated_definition defined by exactly one Interconnect_module_usage_view. Each Interconnect_module_usage_view defines associated_definition for zero, one, or more Interconnect_module_terminal objects.

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4.3.578 Interconnect_module_usage_view to Functional_unit_usage_view

Each Interconnect_module_usage_view has implemented_function defined by zero or one Functional_unit_usage_view. Each Functional_unit_usage_view defines implemented_function for zero, one, or more Interconnect_module_usage_view objects.

4.3.579 Interconnect_module_usage_view to Located_interconnect_module_thickness_requirement

Each Interconnect_module_usage_view has overall_thickness_requirement defined by exactly one Located_interconnect_module_thickness_requirement. Each Located_interconnect_module_thickness_requirement has design defined by one or more Interconnect_module_usage_view objects.

4.3.580 Interface_component_allocation to Interface_component

Each Interface_component_allocation has mating_solution defined by exactly one Interface_component. Each Interface_component defines mating_solution for zero, one, or more Interface_component_allocation objects.

4.3.581 Interface_component_allocation to Mating_connector_component

Each Interface_component_allocation has mating_requirement defined by exactly one Mating_connector_component. Each Mating_connector_component defines mating_requirement for zero, one, or more Interface_component_allocation objects.

4.3.582 Interface_mounted_join to Component_interface_terminal

Each Interface_mounted_join has connection_to_interconnect_module_component defined by exactly one Component_interface_terminal. Each Component_interface_terminal defines connection_to_interconnect_module_component for zero, one, or more Interface_mounted_join objects.

4.3.583 Interface_mounted_join to Component_terminal

Each Interface_mounted_join has access_to_interface_mounted_component defined by exactly one Component_terminal. Each Component_terminal defines access_to_interface_mounted_component for zero, one, or more Interface_mounted_join objects.

4.3.584 Interface_requirement_occurrence to Next_higher_assembly_interface_requirement

Each Interface_requirement_occurrence has interface_to_next_higher_assembly defined by exactly one Next_higher_assembly_interface_requirement. Each Next_higher_assembly_interface_requirement defines interface_to_next_higher_assembly for zero, one, or more Interface_requirement_occurrence objects.

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4.3.585 Interfaced_group_component to Interface_component

Each Interfaced_group_component has group_interface_component defined by one or more Interface_component objects. Each Interface_component defines group_interface_component for zero, one, or more Interfaced_group_component objects.

4.3.586 Internal_probe_access_area to Stratum_feature

Each Internal_probe_access_area has stratum_feature_implementation defined by exactly one Stratum_feature. Each Stratum_feature defines stratum_feature_implementation for zero, one, or more Internal_probe_access_area objects.

4.3.587 Internal_stratum_access to Internal_probe_access_area

Each Internal_stratum_access has connected_probe defined by exactly one Internal_probe_access_area. Each Internal_probe_access_area defines connected_probe for zero, one, or more Internal_stratum_access objects.

4.3.588 Internal_stratum_access to Via

Each Internal_stratum_access has inter_stratum_feature defined by exactly one Via. Each Via defines inter_stratum_feature for zero, one, or more Internal_stratum_access objects.

4.3.589 Item_restricted_requirement_occurrence to Assembly_component

Each Item_restricted_requirement_occurrence has basis defined by zero or one Assembly_component. Each Assembly_component defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and component_or_component_feature.

4.3.590 Item_restricted_requirement_occurrence to Component_feature

Each Item_restricted_requirement_occurrence has basis defined by zero or one Component_feature. Each Component_feature defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and component_or_component_feature.

4.3.591 Item_restricted_requirement_occurrence to Ee_requirement_occurrence

Each Item_restricted_requirement_occurrence has basis defined by zero or one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item.

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4.3.592 Item_restricted_requirement_occurrence to Inter_stratum_feature

Each Item_restricted_requirement_occurrence has basis defined by zero or one Inter_stratum_feature. Each Inter_stratum_feature defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.593 Item_restricted_requirement_occurrence to Laminate_component

Each Item_restricted_requirement_occurrence has basis defined by zero or one Laminate_component. Each Laminate_component defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.594 Item_restricted_requirement_occurrence to Stratum

Each Item_restricted_requirement_occurrence has basis defined by zero or one Stratum. Each Stratum defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item.

Each Item_restricted_requirement_occurrence has basis defined by zero or one Stratum. Each Stratum defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.595 Item_restricted_requirement_occurrence to Stratum_feature

Each Item_restricted_requirement_occurrence has basis defined by zero or one Stratum_feature. Each Stratum_feature defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.596 Item_restricted_requirement_occurrence to Stratum_surface

Each Item_restricted_requirement_occurrence has basis defined by zero or one Stratum_surface. Each Stratum_surface defines basis for zero, one, or more Item_restricted_requirement_occurrence objects. This assertion is established through restriction_basis_item and Stratum_concept.

4.3.597 Join_relationship to Layer_connection_point

Each Join_relationship has points_to_be_connected defined by two or more Layer_connection_point objects. Each Layer_connection_point has join_path defined by one or more Join_relationship objects.

4.3.598 Join_two_physical_connectivity_definition_supporting_printed_component to Physical_connectivity_definition

Each Join_two_physical_connectivity_definition_supporting_printed_component has joined_definitions defined by exactly two Physical_connectivity_definition objects. Each Physical_connectivity_definition defines joined_definitions for zero, one, or more Join_two_physical_connectivity_definition_supporting_printed_component objects.

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4.3.599 Junction_vertex_allocation to Explicitly_located_layer_connection_point

Each Junction_vertex_allocation has implementation_point defined by zero or one Explicitly_located_-layer_connection_point. Each Explicitly_located_layer_connection_point defines implementation_point for zero, one, or more Junction_vertex_allocation objects. This assertion is established through trace_-junction_or_via.

4.3.600 Junction_vertex_allocation to Inter_stratum_join_relationship

Each Junction_vertex_allocation has implementation_point defined by zero or one Inter_stratum_join_-relationship. Each Inter_stratum_join_relationship defines implementation_point for zero, one, or more Junction_vertex_allocation objects. This assertion is established through trace_junction_or_via.

4.3.601 Junction_vertex_allocation to Topological_junction

Each Junction_vertex_allocation has required_vertex defined by exactly one Topological_junction. Each Topological_junction defines required_vertex for zero, one, or more Junction_vertex_allocation objects.

4.3.602 Laminate_component to Part_template

Each Laminate_component has usage_definition defined by exactly one Part_template. Each Part_template defines usage_definition for zero, one, or more Laminate_component objects.

4.3.603 Laminate_text_component to Part_text_template

Each Laminate_text_component has usage_definition defined by exactly one Part_text_template. Each Part_text_template defines usage_definition for zero, one, or more Laminate_text_component objects.

4.3.604 Laminate_text_component to Stratum_feature

Each Laminate_text_component has stratum_feature_implementation defined by exactly one Stratum_-feature. Each Stratum_feature defines stratum_feature_implementation for zero, one, or more Laminate_text_component objects.

4.3.605 Land to Land_physical_template

Each Land has alternate_land_definition defined by zero or one Land_physical_template. Each Land_-physical_template defines alternate_land_definition for zero, one, or more Land objects.

Each Land has usage_definition defined by exactly one Land_physical_template. Each Land_physical_-template defines usage_definition for zero, one, or more Land objects.

4.3.606 Land_interface_terminal to Land

Each Land_interface_terminal has associated_component defined by exactly one Land. Each Land has interface_access_mechanism defined by exactly one Land_interface_terminal.

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4.3.607 Land_interface_terminal to Land_template_interface_terminal

Each Land_interface_terminal has definition defined by exactly one Land_template_interface_terminal. Each Land_template_interface_terminal defines definition for zero, one, or more Land_interface_terminal objects.

4.3.608 Land_join_terminal to Land

Each Land_join_terminal has associated_component defined by exactly one Land. Each Land has access_mechanism defined by one or more Land_join_terminal objects.

4.3.609 Land_join_terminal to Land_template_join_terminal

Each Land_join_terminal has definition defined by exactly one Land_template_join_terminal. Each Land_template_join_terminal defines definition for zero, one, or more Land_join_terminal objects.

4.3.610 Land_physical_template to External_definition

Each Land_physical_template has pre_defined_classification_code defined by zero or one External_definition. Each External_definition defines pre_defined_classification_code for zero, one, or more Land_physical_template objects.

4.3.611 Land_template_terminal to Connection_zone

Each Land_template_terminal has terminal_connection_zone defined by one or more Connection_zone objects. Each Connection_zone defines terminal_connection_zone for zero, one, or more Land_template_terminal objects.

4.3.612 Land_template_terminal to Land_physical_template

Each Land_template_terminal has associated_definition defined by exactly one Land_physical_template. Each Land_physical_template has access_mechanisms defined by two or more Land_template_terminal objects.

4.3.613 Layer to External_definition

Each Layer has layer_usage defined by zero or one External_definition. Each External_definition defines layer_usage for zero, one, or more Layer objects.

4.3.614 Layer to Inter_stratum_extent

Each Layer has extent defined by exactly one Inter_stratum_extent. Each Inter_stratum_extent defines extent for zero, one, or more Layer objects.

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4.3.615 Layer_connection_point to Design_layer_stratum

Each Layer_connection_point has resident_design_layer_stratum defined by exactly one Design_layer_-stratum. Each Design_layer_stratum has existence_dependence defined by one or more Layer_connection_point objects.

4.3.616 Layout_spacing_requirement_non_conforming_design_object to Assembly_component

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Assembly_component objects. Each Assembly_component defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_-object objects. This assertion is established through assembly_or_interconnect_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Assembly_component. Each Assembly_component defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select.

4.3.617 Layout_spacing_requirement_non_conforming_design_object to Component_feature

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Component_feature objects. Each Component_feature defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Component_feature. Each Component_feature defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select.

4.3.618 Layout_spacing_requirement_non_conforming_design_object to Component_termination_passage

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Component_termination_passage objects. Each Component_termination_passage defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_-conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Component_termination_passage. Each Component_termination_passage defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

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4.3.619 Layout_spacing_requirement_non_conforming_design_object to Conductive_filled_area

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Conductive_filled_area objects. Each Conductive_filled_area defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Conductive_filled_area. Each Conductive_filled_area defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.620 Layout_spacing_requirement_non_conforming_design_object to Conductor

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Conductor objects. Each Conductor defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Conductor. Each Conductor defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.621 Layout_spacing_requirement_non_conforming_design_object to Cutout

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Cutout objects. Each Cutout defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Cutout. Each Cutout defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

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4.3.622 Layout_spacing_requirement_non_conforming_design_object to Inter_stratum_feature

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Inter_stratum_feature objects. Each Inter_stratum_feature defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Inter_stratum_feature. Each Inter_stratum_feature defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.623 Layout_spacing_requirement_non_conforming_design_object to Laminate_component

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Laminate_component objects. Each Laminate_component defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Laminate_component. Each Laminate_component defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.624 Layout_spacing_requirement_non_conforming_design_object to Land

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Land objects. Each Land defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Land. Each Land defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

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4.3.625 Layout_spacing_requirement_non_conforming_design_object to Layout_spacing_requirement_occurrence

Each Layout_spacing_requirement_non_conforming_design_object has design_requirement defined by exactly one Layout_spacing_requirement_occurrence. Each Layout_spacing_requirement_occurrence defines design_requirement for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects.

4.3.626 Layout_spacing_requirement_non_conforming_design_object to Non_functional_land

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Non_functional_land objects. Each Non_functional_land defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Non_functional_land. Each Non_functional_land defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.627 Layout_spacing_requirement_non_conforming_design_object to Stratum_feature

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Stratum_feature objects. Each Stratum_feature defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Stratum_feature. Each Stratum_feature defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

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4.3.628 Layout_spacing_requirement_non_conforming_design_object to Via

Each Layout_spacing_requirement_non_conforming_design_object has non_conformant_design_object defined by zero or more Via objects. Each Via defines non_conformant_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

Each Layout_spacing_requirement_non_conforming_design_object has reference_design_object defined by zero or one Via. Each Via defines reference_design_object for zero, one, or more Layout_spacing_requirement_non_conforming_design_object objects. This assertion is established through assembly_or_interconnect_design_object_select and Interconnect_module_design_object_select.

4.3.629 Length_trimmed_terminal to Length_data_element

Each Length_trimmed_terminal has maximum_trimmed_length defined by exactly one Length_data_element. Each Length_data_element defines maximum_trimmed_length for zero, one, or more Length_trimmed_terminal objects.

Each Length_trimmed_terminal has minimum_trimmed_length defined by exactly one Length_data_element. Each Length_data_element defines minimum_trimmed_length for zero, one, or more Length_trimmed_terminal objects.

4.3.630 Limit_dimension_representation to Data_element

Each Limit_dimension_representation has lower_dimension_value defined by exactly one Data_element. Each Data_element defines lower_dimension_value for zero, one, or more Limit_dimension_representation objects.

Each Limit_dimension_representation has upper_dimension_value defined by exactly one Data_element. Each Data_element defines upper_dimension_value for zero, one, or more Limit_dimension_representation objects.

4.3.631 Line_width_class to Curve_style

Each Line_width_class has class_member defined by one or more Curve_style objects. Each Curve_style defines class_member for zero, one, or more Line_width_class objects.

4.3.632 Located_interconnect_module_thickness_requirement to Datum

Each Located_interconnect_module_thickness_requirement has reference_location defined by exactly one Datum. Each Datum defines reference_location for zero, one, or more Located_interconnect_module_thickness_requirement objects.

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4.3.633 Located_interconnect_module_thickness_requirement to Length_data_element

Each Located_interconnect_module_thickness_requirement has maximum_thickness_requirement defined by exactly one Length_data_element. Each Length_data_element defines maximum_thickness_requirement for zero, one, or more Located_interconnect_module_thickness_requirement objects.

Each Located_interconnect_module_thickness_requirement has minimum_thickness_requirement defined by exactly one Length_data_element. Each Length_data_element defines minimum_thickness_requirement for zero, one, or more Located_interconnect_module_thickness_requirement objects.

4.3.634 Marking to Axis_placement

Each Marking has placement defined by exactly one Axis_placement. Each Axis_placement defines placement for zero, one, or more Marking objects.

4.3.635 Marking to Configuration_controlled_message

Each Marking has marked_message defined by zero or one Configuration_controlled_message. Each Configuration_controlled_message defines marked_message for zero, one, or more Marking objects. This assertion is established through marked_message_select.

4.3.636 Marking to Ee_material

Each Marking has marking_material defined by exactly one Ee_material. Each Ee_material defines marking_material for zero, one, or more Marking objects.

4.3.637 Marking to Ee_specification

Each Marking has marking_specification defined by exactly one Ee_specification. Each Ee_specification defines marking_specification for zero, one, or more Marking objects.

4.3.638 Marking to structured_text

Each Marking has marked_message defined by zero or one structured_text. Each structured_text defines marked_message for zero, one, or more Marking objects. This assertion is established through marked_message_select.

4.3.639 Marking to Packaged_part

Each Marking has marked_device defined by zero or one Packaged_part. Each Packaged_part defines marked_device for zero, one, or more Marking objects. This assertion is established through markable_item.

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4.3.640 Marking to Pca

Each Marking has marked_device defined by zero or one Pca. Each Pca defines marked_device for zero, one, or more Marking objects. This assertion is established through markable_item.

4.3.641 Marking to Pcb

Each Marking has marked_device defined by zero or one Pcb. Each Pcb defines marked_device for zero, one, or more Marking objects. This assertion is established through markable_item.

4.3.642 Marking to Styled_text

Each Marking has message_representation defined by exactly one Styled_text. Each Styled_text defines message_representation for zero, one, or more Marking objects.

4.3.643 Material_assembly_relationship to Ee_material

Each Material_assembly_relationship has assembly defined by exactly one Ee_material. Each Ee_material defines assembly for zero, one, or more Material_assembly_relationship objects.

Each Material_assembly_relationship has component defined by exactly one Ee_material. Each Ee_material defines component for zero, one, or more Material_assembly_relationship objects.

4.3.644 Material_composition_relationship to Data_element

Each Material_composition_relationship has constituent_amount defined by exactly one Data_element. Each Data_element defines constituent_amount for zero, one, or more Material_composition_relationship objects.

4.3.645 Material_composition_relationship to Ee_material

Each Material_composition_relationship has related_product defined by exactly one Ee_material. Each Ee_material defines related_product for zero, one, or more Material_composition_relationship objects.

Each Material_composition_relationship has relating_product defined by exactly one Ee_material. Each Ee_material defines relating_product for zero, one, or more Material_composition_relationship objects.

4.3.646 Material_composition_relationship to Ee_text

Each Material_composition_relationship has determination_method defined by exactly one Ee_text. Each Ee_text defines determination_method for zero, one, or more Material_composition_relationship objects.

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4.3.647 Material_removal_feature to Material_removal_feature_template

Each Material_removal_feature has material_removal_shape defined by exactly one Material_removal_-feature_template. Each Material_removal_feature_template defines material_removal_shape for zero, one, or more Material_removal_feature objects.

4.3.648 Mating_connector_component to Ee_specification

Each Mating_connector_component has definition defined by zero or one Ee_specification. Each Ee_-specification defines definition for zero, one, or more Mating_connector_component objects. This assertion is established through mating_connector_part.

4.3.649 Mating_connector_component to Packaged_connector

Each Mating_connector_component has definition defined by zero or one Packaged_connector. Each Packaged_connector defines definition for zero, one, or more Mating_connector_component objects. This assertion is established through mating_connector_part.

4.3.650 Mating_connector_component to Printed_connector_template

Each Mating_connector_component has definition defined by zero or one Printed_connector_template. Each Printed_connector_template defines definition for zero, one, or more Mating_connector_component objects. This assertion is established through mating_connector_part.

4.3.651 Mating_connector_placement_relationship to Axis_placement

Each Mating_connector_placement_relationship has connector_placement defined by exactly one Axis_-placement. Each Axis_placement defines connector_placement for zero, one, or more Mating_connector_placement_relationship objects.

4.3.652 Mating_connector_placement_relationship to Mating_connector_component

Each Mating_connector_placement_relationship has placed_connector defined by exactly one Mating_-connector_component. Each Mating_connector_component has placement_context defined by exactly one Mating_connector_placement_relationship.

4.3.653 Mating_connector_placement_relationship to Next_higher_assembly_interface_requirement

Each Mating_connector_placement_relationship has interface_context defined by exactly one Next_-higher_assembly_interface_requirement. Each Next_higher_assembly_interface_requirement defines interface_context for zero, one, or more Mating_connector_placement_relationship objects.

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4.3.654 Mating_connector_termination to Ee_requirement_occurrence

Each Mating_connector_termination has signal_definition defined by zero or one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines signal_definition for zero, one, or more Mating_connector_termination objects.

4.3.655 Mating_connector_termination to Mating_connector_component

Each Mating_connector_termination has accessed_connector defined by exactly one Mating_connector_component. Each Mating_connector_component defines accessed_connector for zero, one, or more Mating_connector_termination objects.

4.3.656 Mating_connector_termination to Packaged_part_terminal

Each Mating_connector_termination has definition defined by zero or one Packaged_part_terminal. Each Packaged_part_terminal defines definition for zero, one, or more Mating_connector_termination objects. This assertion is established through packaged_or_printed_terminal.

4.3.657 Mating_connector_termination to Printed_part_template_terminal

Each Mating_connector_termination has definition defined by zero or one Printed_part_template_terminal. Each Printed_part_template_terminal defines definition for zero, one, or more Mating_connector_termination objects. This assertion is established through packaged_or_printed_terminal.

4.3.658 Maximum_tolerance_characteristic to Numeric_parameter

Each Maximum_tolerance_characteristic has component_characteristic defined by exactly one Numeric_parameter. Each Numeric_parameter defines component_characteristic for zero, one, or more Maximum_tolerance_characteristic objects.

4.3.659 Minimally_defined_bare_die_terminal to Bare_die

Each Minimally_defined_bare_die_terminal has associated_definition defined by exactly one Bare_die. Each Bare_die has access_mechanisms defined by two or more Minimally_defined_bare_die_terminal objects.

4.3.660 Minimally_defined_component_terminal to Part_Terminal_External_Reference

Each Minimally_defined_component_terminal has component_feature defined by exactly one Part_Terminal_External_Reference.

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4.3.661 Minimum_tolerance_characteristic to Numeric_parameter

Each Minimum_tolerance_characteristic has component_characteristic defined by exactly one Numeric_parameter. Each Numeric_parameter defines component_characteristic for zero, one, or more Minimum_tolerance_characteristic objects.

4.3.662 Model_parameter to Characteristic

Each Model_parameter has default_value defined by zero or one Characteristic. Each Characteristic defines default_value for zero, one, or more Model_parameter objects. This assertion is established through scalar_or_coordinated_characteristics.

4.3.663 Model_parameter to Coordinated_characteristic

Each Model_parameter has default_value defined by zero or one Coordinated_characteristic. Each Coordinated_characteristic defines default_value for zero, one, or more Model_parameter objects. This assertion is established through scalar_or_coordinated_characteristics.

Each Model_parameter has valid_range defined by zero or more Coordinated_characteristic objects. Each Coordinated_characteristic defines valid_range for zero, one, or more Model_parameter objects.

4.3.664 Model_parameter to Ee_document

Each Model_parameter has reference_document defined by zero or one Ee_document. Each Ee_document defines reference_document for zero, one, or more Model_parameter objects. This assertion is established through standard_or_reference_document.

4.3.665 Model_parameter to Standard_document_identification_string

Each Model_parameter has reference_document defined by zero or one standard_document_identification_string. Each standard_document_identification_string defines reference_document for zero, one, or more Model_parameter objects. This assertion is established through standard_or_reference_document.

4.3.666 Mounting_restriction_area to Feature_shape_occurrence

Each Mounting_restriction_area has area defined by exactly one Feature_shape_occurrence. Each Feature_shape_occurrence defines area for zero, one, or more Mounting_restriction_area objects.

4.3.667 Mounting_restriction_area to Interconnect_module

Each Mounting_restriction_area has scope defined by one or more Interconnect_module objects. Each Interconnect_module defines scope for zero, one, or more Mounting_restriction_area objects.

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4.3.668 Mounting_restriction_area to Interconnect_module_component_surface_feature

Each Mounting_restriction_area has mounting_surface defined by one, two, or three Interconnect_module_component_surface_feature objects. Each Interconnect_module_surface_component_feature defines scope for zero, one, or more Mounting_restriction_area objects.

4.3.669 Next_higher_assembly_interface_requirement to Bound_volume_shape

Each Next_higher_assembly_interface_requirement has shape defined by exactly one Bound_volume_shape. Each Bound_volume_shape defines shape for zero, one, or more Next_higher_assembly_interface_requirement objects.

4.3.670 Next_higher_assembly_interface_requirement to Ee_product_version

Each Next_higher_assembly_interface_requirement has version_of_next_higher_assembly defined by exactly one Ee_product_version. Each Ee_product_version defines version_of_next_higher_assembly for zero, one, or more Next_higher_assembly_interface_requirement objects.

4.3.671 Next_higher_assembly_relationship to Data_element

Each Next_higher_assembly_relationship has quantity defined by zero or one Data_element. Each Data_element defines quantity for zero, one, or more Next_higher_assembly_relationship objects.

4.3.672 Non_functional_land to Land_physical_template

Each Non_functional_land has alternate_land_definition defined by zero or one Land_physical_template. Each Land_physical_template defines alternate_land_definition for zero, one, or more Non_functional_land objects.

Each Non_functional_land has usage_definition defined by exactly one Land_physical_template. Each Land_physical_template defines usage_definition for zero, one, or more Non_functional_land objects.

4.3.673 Non_functional_land_interface_terminal to Land_template_interface_terminal

Each Non_functional_land_interface_terminal has definition defined by exactly one Land_template_interface_terminal. Each Land_template_interface_terminal defines definition for zero, one, or more Non_functional_land_interface_terminal objects.

4.3.674 Non_functional_land_interface_terminal to Non_functional_land

Each Non_functional_land_interface_terminal has associated_component defined by exactly one Non_functional_land. Each Non_functional_land has interface_access_mechanism defined by exactly one Non_functional_land_interface_terminal.

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4.3.675 Non_functional_land_join_terminal to Land_template_join_terminal

Each Non_functional_land_join_terminal has definition defined by exactly one Land_template_join_-terminal. Each Land_template_join_terminal defines definition for zero, one, or more Non_functional_-land_join_terminal objects.

4.3.676 Non_functional_land_join_terminal to Non_functional_land

Each Non_functional_land_join_terminal has associated_component defined by exactly one Non_functional_land. Each Non_functional_land has access_mechanism defined by one or more Non_functional_land_join_terminal objects.

4.3.677 Numeric_parameter to Data_element

Each Numeric_parameter has property_value defined by exactly one Data_element. Each Data_element defines property_value for zero, one, or more Numeric_parameter objects.

4.3.678 Operational_requirement_occurrence_relationship to Ee_requirement_occurrence

Each Operational_requirement_occurrence_relationship has related_requirement_occurrence defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines related_requirement_-occurrence for zero, one, or more Operational_requirement_occurrence_relationship objects.

Each Operational_requirement_occurrence_relationship has relating_requirement_occurrence defined by exactly one Ee_requirement_occurrence. Each Ee_requirement_occurrence defines relating_requirement_occurrence for zero, one, or more Operational_requirement_occurrence_relationship objects.

4.3.679 Opposing_boundary_set_size_characteristic to Tolerance_zone_opposing_boundary_set

Each Opposing_boundary_set_size_characteristic has sized_boundary_set defined by exactly one Tolerance_zone_opposing_boundary_set. Each Tolerance_zone_opposing_boundary_set has size_characteristic defined by exactly one Opposing_boundary_set_size_characteristic.

4.3.680 Package to Axis_placement

Each Package has seating_plane defined by exactly one Axis_placement.

4.3.681 Package to Cartesian_point

Each Package has least_material_condition_centroid_location defined by zero or one Cartesian_point. Each Package has maximum_material_condition_centroid_location defined by zero or one Cartesian_-point.

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4.3.682 Package to Length_data_element

Each Package has least_lead_length_below_seating_plane defined by zero or one Length_data_element. Each Length_data_element defines least_lead_length_below_seating_plane for zero, one, or more Package objects.

Each Package has maximum_body_clearance_above_seating_plane defined by zero or one Length_data_element. Each Package has minimum_body_clearance_above_seating_plane defined by zero or one Length_data_element.

Each Package has maximum_body_height_above_seating_plane defined by exactly one Length_data_element. Each Length_data_element defines maximum_body_height_above_seating_plane for zero, one, or more Package objects.

Each Package has maximum_body_height_below_seating_plane defined by zero or one Length_data_element. Each Length_data_element defines maximum_body_height_below_seating_plane for zero, one, or more Package objects.

Each Package has maximum_lead_length_below_seating_plane defined by zero or one Length_data_element. Each Length_data_element defines maximum_lead_length_below_seating_plane for zero, one, or more Package objects.

4.3.683 Package to Registered_style

Each Package has case_style defined by one or more Registered_style objects. Each Registered_style defines case_style for zero, one, or more Package objects.

4.3.684 Package_body to Ee_material

Each Package_body has body_material defined by exactly one Ee_material. Each Ee_material defines body_material for zero, one, or more Package_body objects.

4.3.685 Package_body to Package

Each Package_body has associated_definition defined by exactly one Package. Each Package has body defined by zero or one Package_body.

4.3.686 Package_terminal to Analytical_representation

Each Package_terminal has model_representation defined by zero or more Analytical_representation objects. Each Analytical_representation defines model_representation for zero, one, or more Package_terminal objects.

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4.3.687 Package_terminal to Characteristic

Each Package_terminal has terminal_characteristic defined by zero or more Characteristic objects. Each Characteristic defines terminal_characteristic for zero, one, or more Package_terminal objects.

4.3.688 Package_terminal to Connection_zone

Each Package_terminal has external_connection_zone defined by one or more Connection_zone objects. Each Connection_zone defines external_connection_zone for zero, one, or more Package_terminal objects. Each Package_terminal has internal_connection_zone defined by zero, one, or more Connection_zone objects.

4.3.689 Package_terminal to Feature_shape_occurrence

Each Package_terminal has feature_shape defined by one or more Feature_shape_occurrence objects. Each Feature_shape_occurrence defines feature_shape for zero, one, or more Package_terminal objects.

4.3.690 Package_terminal to Material_assembly_relationship

Each Package_terminal has terminal_core_material defined by exactly one Material_assembly_relationship. Each Material_assembly_relationship defines terminal_core_material for zero, one, or more Package_terminal objects.

Each Package_terminal has terminal_surface_material defined by exactly one Material_assembly_relationship. Each Material_assembly_relationship defines terminal_surface_material for zero, one, or more Package_terminal objects.

4.3.691 Package_terminal to Package

Each Package_terminal has associated_definition defined by exactly one Package. Each Package has package_accesses defined by one or more Package_terminal objects.

4.3.692 Package_terminal_occurrence to Package_terminal

Each Package_terminal_occurrence has definition defined by exactly one Package_terminal. Each Package_terminal defines definition for zero, one, or more Package_terminal_occurrence objects.

4.3.693 Package_terminal_occurrence to Packaged_component

Each Package_terminal_occurrence has associated_component defined by exactly one Packaged_component. Each Packaged_component defines associated_component for zero, one, or more Package_terminal_occurrence objects.

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4.3.694 Packaged_component to altered_package

Each Packaged_component has selected_package_alternate defined by zero or one altered_package. Each altered_package defines selected_package_alternate for zero, one, or more Packaged_component objects.

4.3.695 Packaged_component to Packaged_part

Each Packaged_component has usage_definition defined by exactly one Packaged_part. Each Packaged_part defines usage_definition for zero, one, or more Packaged_component objects.

4.3.696 Packaged_component_join_terminal to Length_data_element

Each Packaged_component_join_terminal has maximum_wire_terminal_length defined by zero or one Length_data_element. Each Length_data_element defines maximum_wire_terminal_length for zero, one, or more Packaged_component_join_terminal objects.

Each Packaged_component_join_terminal has minimum_wire_terminal_length defined by zero or one Length_data_element. Each Length_data_element defines minimum_wire_terminal_length for zero, one, or more Packaged_component_join_terminal objects.

4.3.697 Packaged_component_join_terminal to Packaged_component

Each Packaged_component_join_terminal has associated_component defined by exactly one Packaged_component. Each Packaged_component has access_mechanism defined by one or more Packaged_component_join_terminal objects.

4.3.698 Packaged_component_join_terminal to Packaged_part_join_terminal

Each Packaged_component_join_terminal has definition defined by exactly one Packaged_part_join_terminal. Each Packaged_part_join_terminal defines definition for zero, one, or more Packaged_component_join_terminal objects.

4.3.699 Packaged_connector_component to Packaged_connector

Each Packaged_connector_component has usage_definition defined by exactly one Packaged_connector. Each Packaged_connector defines usage_definition for zero, one, or more Packaged_connector_component objects.

4.3.700 Packaged_connector_component_interface_terminal to Packaged_connector_component

Each Packaged_connector_component_interface_terminal has associated_component defined by exactly one Packaged_connector_component. Each Packaged_connector_component has interface_access_mechanism defined by one or more Packaged_connector_component_interface_terminal objects.

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