

VDA working group “CAD/CAM”

VDA KBL

# Harness Description List (KBL)

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## Package: ::KBL

This UML model defines how electrical/logical data coming from CAE systems (usages of components, connections, etc.) and topological data coming from 3D CAD systems (routing of cables and bundles) should be represented in an integrated way:

- Part identification including versioning, references to car projects or supplier information
- Harness, variants and options
- Modules to support modular design
- Harness components like connectors, wires, fixings, grommets or accessories
- Connectivity lists
- Part usage lists
- Topology and routing
- References to drawings or manufacturing documents

For various reasons, there may be some classes that cannot be completely populated in an implementation (e.g. XML file). Sometimes an application may not maintain all the information that is anticipated for the data exchange. Other times, the information may be maintained by a sending system but not included in the data exchange. Never the less, the interface must provide values for all mandatory attributes in an exchange file. When no data is provided by a sending system for a string value, the interface shall use '/NULL' or the empty string "".

To further indicate the reason why no data is provided, the following convention shall be used:

- Empty string "" indicates user data managed by the sending system but not provided for data exchange;
- String '/NULL' indicates user data in a mandatory attribute that is not managed by the sending system or currently not known;

In general, the empty null string "" or the default string '/NULL' shall not be used as valid user data.

## Package: ::KBL::1\_Harness

This package specifies the information needed to describe the exchange context, i.e. the harness with its decomposition into modules. It also includes the information needed to build variants and control the individual components with respect to options and logistic control information.

### Classes

#### Class: Connection\_or\_occurrence

A Connection\_or\_occurrence is an object that is controlled by a Module or a Harness.

#### Class: Harness

Kabelbaum

All wires in the car need to connect the ECU's, sensors, switches, and actuators. The harness depends on the car configuration.

A Harness is an assembly of insulated conductors formed to a predetermined pattern or configuration.

#### Attributes

##### public Content

The content specifies the information covered by the Harness.

The following values shall be used:

- 'Harness Complete Set'
- 'Harness Subset'

## Associations

### Components: Connection\_or\_occurrence [0..\*]

The Components specifies the part occurrences and connectiosn which belong to the Harness.

### Harness\_configuration: Harness\_configuration [0..\*]

The harness\_configuration specifies the configurations of the Harness.

### Module: Module [0..\*]

The module specifies the modules belonging to the harness.

Note: A Module belong to one harness, only. This is no restriction, as there can be only one harness object exchanged by one file.

### Module\_configuration: Module\_configuration [0..\*]

The module\_configuration specifies the direct control of components outside of modules.

### Module\_families: Module\_family [0..\*]

## Class: Harness\_configuration

Kabelbaumvariante

A superset of all available functions (150%) is described in function diagram. The harness configuration describes the harness of useful car configurations.

A Harness\_configuration is a variant of an harness.

### Attributes

#### public Logistic\_control\_information [0..1]

The logistic\_control\_information specifies the calculated combination of the configuration codes reflecting customer, market or country requirements associated with a Harness\_configuration.

Example: 'LOL/LOR+CFL'

### Associations

#### Modules: Module [1..\*]

The modules specifies the Module objects which build up the Harness\_configuration.

## Class: Harness\_content

### Attributes

public harness complete set

public harness subset

## Class: KBL\_container

The KBL\_container is introduced to specify the information which can be exchanged by one file.

### Associations

#### Accessory: Accessory [0..\*]

The accessory specifies the Accessory objects contained in KBL\_container.

#### Approval: Approval [0..\*]

The approval specifies the Approval objects contained in KBL\_container.

#### Assembly\_part: Assembly\_part [0..\*]

The assembly\_part specifies the Assembly\_part objects contained in KBL\_container.

#### Cartesian\_point: Cartesian\_point [0..\*]

#### Cavity\_plug: Cavity\_plug [0..\*]

The cavity\_plug specifies the Cavity\_plug objects contained in KBL\_container.

#### Cavity\_seal: Cavity\_seal [0..\*]

The cavity\_seal specifies the Cavity\_seal objects contained in KBL\_container.

**Co\_pack\_part: Co\_pack\_part [0..\*]**

The co\_pack\_part specifies the Co\_pack\_part objects contained in KBL\_container.

**Component: Component [0..\*]**

The component specifies the Component objects contained in KBL\_container.

**Connector\_housing: Connector\_housing [0..\*]**

The connector\_housing specifies the Connector\_housing objects contained in KBL\_container.

**Creation: Creation [0..\*]**

The creation specifies the Creation objects contained in KBL\_container.

**Dimension\_specification: Dimension\_specification [0..\*]**

**External\_reference: External\_reference [0..\*]**

The external\_reference specifies the External\_reference objects contained in KBL\_container.

**Fixing: Fixing [0..\*]**

The fixing specifies the Fixing objects contained in KBL\_container.

**General\_terminal: General\_terminal [0..\*]**

The general\_terminal specifies the General\_terminal objects contained in KBL\_container.

**General\_wire: General\_wire [0..\*]**

The general\_wire specifies the General\_wire objects contained in KBL\_container.

**Harness: Harness [0..1]**

The harness specifies the Harness objects contained in KBL\_container.

**Node: Node [0..\*]**

The node specifies the Node objects contained in KBL\_container.

**Routing: Routing [0..\*]**

The routing specifies the Routing objects contained in KBL\_container.

**Segment: Segment [0..\*]**

The segment specifies the Segment objects contained in KBL\_container.

**Unit: Unit [0..\*]**

The unit specifies the Unit objects contained in KBL\_container.

**Wire\_protection: Wire\_protection [0..\*]**

The wire\_protection specifies the Wire\_protection objects contained in KBL\_container.

## Class: Module

A Module is a physical part of harness electrically defined by one or more module groups including required harness furniture.

### Attributes

**public Content**

The content specifies the information covered by the Module.

The following values shall be used:

- 'variant'
- 'module'

### Associations

**Module\_configuration: Module\_configuration [1]**

The module\_configuration specifies the Module\_configuration the Module represents.

**Of\_family: Module\_family [0..1]**

The of\_family specifies the Module\_family to which the Module belongs to.

## Class: Module\_configuration

A Module\_configuration is a grouping of wires and components fulfilling a specific functionality of a harness.

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Example:

Option: Audio System with CD Changer

## Attributes

### public Configuration\_type [0..1]

The configuration\_type specifies further information on the type of the logistic\_control\_information.

Note: To control completion parts which are only used if a specific combination of modules occur, a Module\_configuration can be used with a logistic\_control\_information containing the Boolean expression for the combination and a configuration\_type 'module list'.

Where applicable the following values shall be used:

- 'option code': the logistic\_control\_information contains configuration codes reflecting customer, market or country requirements
- 'module list': the logistic\_control\_information contains a list of modules, to which a completion part controlled by the Modul\_configuration belongs to

### public Logistic\_control\_information

The logistic\_control\_information specifies the calculated combination of the configuration codes reflecting customer, market or country requirements, or a list of modules associated with a Module\_configuration.

The meaning of the string is further described by the configuration\_type.

Example: 'LOL/LOR+CFL'

## Associations

### Controlled\_components: Connection\_or\_occurrence [0..\*]

The controlled\_components specifies the components which are grouped by the Module\_configuration.

## Class: Module\_configuration\_type

### Attributes

public module list

public option code

## Class: Module\_content

### Attributes

public module

public variant

## Class: Module\_family

Funktionsfamilie

Description of a set of modules.

A Module\_family is a mechanism to group mutually exclusive modules.

EXAMPLE "audio equipment"

### Attributes

#### public Description [0..1]

The description specifies additional information about the Module\_family.

#### public Id

The id specifies the identifier of the Module\_family.

## Package: ::KBL::2\_Parts

This package specifies the part master information of the harness components. It defines the attributes

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necessary to provide further information on parts like wires or accessories. It further provides the capability to describe the information, which is common to all kind of parts. This includes basic attributes like part number or mass and also more complex descriptions like material or change information.

## Classes

### Class: Accessory

Zubehör

Components which may be used with connectors to facilitate their use in a wide range of applications. Accessories perform no electrical function and include such items as caps, covers, gaskets washers and boots.

An Accessory is any supplementary portion of a connector with the obligation to help a Harness to perform its function.

Example: An Accessory may be a sleeve, a cap, a cable strap or comparable parts, which are installed to a plug.

#### Attributes

##### public Accessory\_type [0..1]

The accessory\_type specifies the type of an Accessory.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

### Class: Assembly\_part

Teilmontiertes Bauteil

An assembly of multiple parts identified by a common part number.

An Assembly\_part is a component that contains other subordinate objects. An Assembly\_part is ordered as a part to be bought under a part number, due to limited functionalities of the CAD systems these must be described however with several individual parts.

#### Attributes

##### public Part\_type [0..1]

The part\_type specifies the type of an Assembly\_part.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

#### Associations

##### Components: Connection\_or\_occurrence [0..\*]

The components specifies the Parts of which the Assembly\_part consists.

### Class: Cavity

Kontaktkammer

A cavity is a defined space in a housing for location of an electrical terminal or cavity plug/seal (can be empty).

#### Attributes

##### public Cavity\_number

The cavity\_number specifies the identifier of the Cavity.

Note: The uniqueness of a cavity id within a harness is fulfilled by the concatenation of the connector id, the slot id, and the cavity id.

### Class: Cavity\_plug

Blindstopfen

Connector accessory to fill and seal empty cavities

A Cavity\_plug is a water tight non-electrical object to fill an empty cavity.

### Attributes

#### public Colour [0..1]

The colour specifies the colour of the Cavity\_plug.

#### public Plug\_type [0..1]

The plug\_type specifies the type of a Cavity\_plug.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

### Class: Cavity\_seal

Kontaktkammerversiegelung

Connector accessory to fill and seal a populated cavity.

A Cavity\_seal is a water tight non-electrical object to fill a populated Cavity.

### Attributes

#### public Colour [0..1]

The colour specifies the colour of the Cavity\_seal.

#### public Seal\_type [0..1]

The seal\_type specifies the type of a Cavity\_seal.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

#### public Wire\_size [0..1]

The wire\_size specifies the size range of the wires the seal fits.

### Class: Co\_pack\_part

Kabelbaumzubehör

A Co\_pack\_part is a Part which is supplied and installed with the wiring harness, but without any electrical connection.

### Attributes

#### public Part\_type [0..1]

The part\_type specifies the type of a Co\_pack\_part.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

### Class: Component

A Component is an object which belongs to the harness.

Example: Fuse, fusebox, relay sockets

### Class: Connector\_housing

Steckergehäuse

Body of the connector with 1-n cavities.

A Connector\_housing is a non populated connector, i.e. without addressed/populated cavities.

A Connector\_housing without any slot allows for the representation of a connector shell (Mehrfachstecker)

### Attributes

#### public Housing\_code [0..1]

The housing\_code specifies a coding for the type of the Connector\_housing.

#### public Housing\_colour [0..1]

The housing\_colour specifies the colour of the Connector\_housing.

#### public Housing\_type [0..1]

The housing\_type specifies the type of a Connector\_housing.

Example: family series type like 'MQS2.8'

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

## Associations

### Slots: Slot [0..\*]

The slots specifies the Slots which belong to the Connector\_housing.

## Class: Core

Kabelader

A core is part of a cable. A cable consists of 1-n cores

A Core is a single conductor of a multi-core wire including its isolation.

## Attributes

### public Bend\_radius [0..1]

The bend\_radius specifies the bend radius of a core.

### public Cable\_designator [0..1]

The cable\_designator specifies additional information to refer to a Core.

### public Cross\_section\_area

The cross\_section\_area specifies the electrical cross section of the Core.

### public Id

The id specifies the identifier of the Core.

### public Outside\_diameter [0..1]

The outside\_diameter specifies the outer width of the Core.

### public Wire\_type [0..1]

The wire\_type specifies the type of a Core.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

Example: 'protected wire', 'flat band'.

## Associations

### Core\_colour: Wire\_colour [1..\*]

The Core\_colour specifies the Wire\_colour objects of the core.

## Class: Fixing

Kabelbefestigung

A Fixing is an accessory part of the harness, used to fix the position. Fixing elements cover all parts, that are used in cable section.

Example: clips, sleeves, cable ducts, grommet, etc.

## Attributes

### public Fixing\_type [0..1]

The fixing\_type specifies the type of a Fixing.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

Example: Examples are 'fastening part', 'channel', 'sleeve', 'shaft', 'conduct', 'pine-tree'

## Class: General\_terminal

Kontakt

A General\_terminal is a device designed to terminate a conductor to be affixed usually to a post, stud, chassis, or other conductor or the like in order to establish electrical connection.

Note: A General\_terminal describes the active part of the connector, which connects electrical, equal to "contact".

## Attributes

**public Cross\_section\_area [0..1]**

The cross\_section\_area specifies the electrical cross section, which can be accommodated by the General\_terminal.

**public Outside\_diameter [0..1]**

The outside\_diameter specifies the outer width of the isolation, which can be accommodated by the General\_terminal.

**public Plating\_material [0..1]**

The plating\_material specifies the overlaying of a thin coating of metal on components to improve conductivity, provide for easy soldering or prevent rusting or corrosion.

**public Terminal\_type [0..1]**

The terminal\_type specifies the type of a General\_terminal.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners. Example: 'pin', 'Blade', 'male', 'female', 'grease', 'FL - flat contact', 'KK - box contact', 'SK - ring wire', 'RK - ring lug', 'KS - lug', 'BK - battery clamp', 'OL - open line end of frame', 'SP - splice', 'MK - multiple contact'

**Class: General\_wire**

A General\_wire is a physical wire, performing electrical connection. A General\_wire can either be used to define a single wire or a multi-core wire.

**Attributes**

**public Bend\_radius [0..1]**

The bend\_radius specifies the bend radius of a wire.

**public Cable\_designator [0..1]**

The cable\_designator specifies additional information to refer to a General\_wire.

**public Cross\_section\_area [0..1]**

The cross\_section\_area specifies the electrical cross section of the General\_wire.

**public Outside\_diameter [0..1]**

The outside\_diameter specifies the outer width of the General\_wire.

**public Wire\_type [0..1]**

The wire\_type specifies the type of a General\_wire.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

Example: 'individual wire', 'multi-core wire', 'protected wire', 'flat band'.

**Associations**

**Core: Core [0..\*]**

The Core specifies the constituents of the multi-core wire.

**Cover\_colour: Wire\_colour [1..\*]**

The cover\_colour specifies the Wire\_colour objects of a General\_wire. In the case of a single wire it specifies the colour of the conductor. In case of a multi-core wire it specifies the colour of the cover.

**Class: Part**

Bauteil, Komponente

A part is an element of a product relevant for a bill-of material.

**Attributes**

**public Abbreviation**

The abbreviation specifies a short name for a Part.

**public Alias\_id [0..\*]**

The alias\_id specifies an additional part\_number that is used to identify the Part in another organizational context (e.g. company).

**public Company\_name**

The `company_name` specifies the name of the organizational context in which the `Part_number` is defined.

**public Copyright\_note [0..1]**

The `copyright_note` specifies copyright information for a Part.

**public Degree\_of\_maturity [0..1]**

The `degree_of_maturity` specifies the degree of maturity of a Part.

Where applicable the following values shall be used:

- 'draft'
- 'planning'
- 'equipment order'
- 'disposition'

**public Description**

The `description` specifies additional information about the Part.

**public Mass\_information [0..1]**

The `mass_information` specifies the mass of a Part.

Example: Valid values for the unit of the `Numerical_value` specifying the mass are 'gram', 'kilogram', or also 'kg/piece', 'gram/meter'

**public Part\_number**

The `part_number` specifies the identifier of the Part. The format of the part number is user defined (OEM specific).

**public Predecessor\_part\_number [0..1]**

The `predecessor_part_number` specifies the part number of the predecessor of the Part.

**public Version**

The `version` specifies the version identifier of the Part. A version cumulates and consolidates one or more single changes.

**Associations**

**Change: Change [0..\*]**

The `change` specifies the change history of the Part .

**External\_references: External\_reference [0..\*]**

The `external_references` specifies references to documents.

**Material\_information: Material [0..1]**

The `material_information` specifies the material of a Part.

**Processing\_information: Processing\_instruction [0..\*]**

The `processing_information` provides additional information for the processing of the Part.

**Class: Part\_with\_title\_block**

A `Part_with_title_block` is a mechanism to assign additional information to a Harness, a Harness\_configuration or a Module.

**Attributes**

**public Car\_classification\_level\_2**

The `car_classification_level_2` provides a classification according to "CC8 Recommended Practices Specification and Configuration, Product Structures". Car classification is the identification of a set of similar cars to be offered to the market. Level 2 stands for "Technical information / platform" and reflects the level of a product class in a BoM system which represents a main technical product base (e.g. project, platform, engineering series etc.). In some cases this level carries a complete BoM ("Maximum BoM") for a project, platform, engineering series etc. This level is in some cases called technical documentation.

**public Car\_classification\_level\_3 [0..1]**

The `car_classification_level_3` provides a classification according to "CC8 Recommended Practices Specification and Configuration, Product Structures". Car classification is the identification of a set of similar cars to be offered to the market. Level 3 stands for "Configuration information / product family" where all

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variant control mechanism are attached.

**public Car\_classification\_level\_4 [0..1]**

The car\_classification\_level\_4 provides a classification according to "CC8 Recommended Practices Specification and Configuration, Product Structures". Car classification is the identification of a set of similar cars to be offered to the market. Level 4 stands for "Furthest pre-configured abstract product class" and represents the furthest configured class of a product, which is not yet a real product. E.g. this could be a complete vehicle, engine, gear-box etc. which has not been evaluated against customer special choices or a abstract vehicle, engine, gear-box etc. which could become a real one after the associated BoM is evaluated. The purpose of this level of a product class instance is in any case to reflect that level of product class of a BoM system which leads to the individual BoM for a single product.

**public Model\_year**

The model\_year specifies the year of the car model.

**public Project\_number [0..1]**

The project\_number specifies the development order number (car or engine project)

**Class: Slot**

A Slot is a mechanism to group the Cavity objects of a Connector\_housing.

**Attributes**

**public Id [0..1]**

The id specifies the identifier of the Slot.

**public Number\_of\_cavities**

The number\_of\_cavities specifies the number of cavities associated with the Slot.

**Associations**

**Cavities: Cavity [1..\*]**

The cavities specifies the Cavity objects belonging to the Slot.

**Class: Wire\_protection**

Kabelschutzmantel

A Wire\_protection is a mechanism to describe harness wrappings, a shield to prevent the wire from damaging.. It covers all kinds of wrappings modeled by CAD systems.

**Attributes**

**public Protection\_type [0..1]**

The protection\_type specifies the type of the Wire\_protection.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners. Example: 'coil', 'corrugated pipe', 'foam rubber strip'

**public Type\_dependent\_parameter [0..1]**

The type\_dependent\_parameter specifies further information dependent on the type of the Wire\_protection.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners. Example: for corrugated pipe: wave shape, for pull-push rule: width.

**Package: ::KBL::3\_Part\_structure**

This package provides the information typically contained in bill of material lists. It describes how a harness is assembled.

**Classes**

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## Class: Accessory\_occurrence

An Accessory\_occurrence is the occurrence of an Accessory in a module part list.

### Attributes

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Accessory\_occurrence.

**public Description [0..1]**

The description specifies additional information about the object.

**public Id**

The id specifies the identifier of the Accessory\_occurrence.

**public Placement [0..1]**

The placement specifies the transformation information, which is used to locate and orient the occurrence in the car coordinate system. For further information see [CESAK].

### Associations

**Part: Accessory [1]**

The part specifies the Accessory that serves as a definition for this particular occurrence.

**Reference\_element: Connector\_occurrence [0..\*]**

The reference\_element specifies the Connector\_occurrence objects supplemented by the Accessory\_occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Accessory\_occurrence.

## Class: Assembly\_part\_occurrence

An Assembly\_part\_occurrence is the occurrence of an Assembly\_part in a module part list.

### Attributes

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Assembly\_part\_occurrence.

**public Description [0..1]**

The description specifies additional information about the object.

**public Id**

The id specifies the identifier of the Assembly\_part\_occurrence.

**public Placement [0..1]**

The placement specifies the transformation information, which is used to locate and orient the occurrence in the car coordinate system. For further information see [CESAK].

### Associations

**Part: Assembly\_part [1]**

The part specifies the Assembly\_part that serves as a definition for this particular occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Connection.

## Class: Cavity\_plug\_occurrence

A Cavity\_plug\_occurrence is the occurrence of a Cavity\_plug in a module part list.

Note: Cavity\_plugs do not show up in a module bill of material.

### Associations

**Part: Cavity\_plug [1]**

The part specifies the Cavity\_plug that serves as a definition for this particular occurrence.

## Class: Cavity\_seal\_occurrence

A Cavity\_seal\_occurrence is the occurrence of a Cavity\_seal in a module.

Note: The number of occurrences used in a specific module or harness can be calculated by the individual occurrences.

Note: The usage of a Cavity\_seal\_occurrence for a particular Cavity is specified by the Part\_usage object.

### Associations

#### Part: Cavity\_seal [1]

The part specifies the Cavity\_seal that serves as a definition for this particular occurrence.

## Class: Co\_pack\_occurrence

A Co\_pack\_occurrence is the occurrence of a Co\_pack\_part in a module part list.

### Attributes

#### public Alias\_id [0..\*]

The alias\_id specifies additional identifiers for the Co\_pack \_occurrence.

#### public Description [0..1]

The description specifies additional information about the object.

#### public Id

The id specifies the identifier of the Co\_pack\_occurrence.

### Associations

#### Part: Co\_pack\_part [1]

The part specifies the Co\_pack\_part that serves as a definition for this particular occurrence.

#### Installation\_information: Installation\_instruction [0..\*]

The installation\_information provides additional information for the installation of the Co\_pack\_occurrence.

## Class: Component\_occurrence

A Component\_occurrence is the occurrence of a Component in a module part list.

### Attributes

#### public Alias\_id [0..\*]

The alias\_id specifies additional identifiers for the Component.

#### public Description [0..1]

The description specifies additional information about the object.

#### public Id

The id specifies the identifier of the Component.

### Associations

#### Part: Component [1]

The part specifies the Component that serves as a definition for this particular occurrence.

#### Mounting: Mounting\_element [1..\*]

The mounting specifies the Cavity\_occurrence, Slot\_occurrence, or Connector\_occurrence, which is associated with the Component\_occurrence.

## Class: Connector\_occurrence

Steckverbinder

A Connector\_occurrence is the occurrence of a Connector\_housing in a module part list.

### Attributes

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Connector\_occurrence.

**public Description [0..1]**

The description specifies additional information about the object.

**public Id**

The id specifies the identifier of the Connector\_occurrence.

**public Placement [0..1]**

The placement specifies the transformation information, which is used to locate and orient the occurrence in the car coordinate system. For further information see [CESAK].

**public Usage [0..1]**

The usage specifies the way how a Connector\_occurrence is used in a connection.

Where applicable the following values shall be used:

- 'no end': end of wire without any connector ("blunt cut")
- 'ring terminal':
- 'splice':
- 'dangler': terminal without any connector housing.

### Associations

**Part: Connector\_housing [1]**

The part specifies the Connector\_housing that serves as a definition for this particular occurrence.

**Contact\_points: Contact\_point [0..\*]**

The contact\_points specify the Contact\_points, which belong to the connector.

Note: All Contact\_points of a Connector\_occurrence shall reference Cavity\_occurrence objects of this Connector\_occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Connector\_occurrence.

**Slots: Slot\_occurrence [0..\*]**

The slots specifies the Slot\_occurrence objects which belong to the Connector\_occurrence.

## Class: Connector\_usage

### Attributes

**public dangler**

**public no end**

**public ring terminal**

**public splice**

## Class: Core\_occurrence

A Core\_occurrence is the occurrence of a Core within a Special\_wire\_occurrence.

### Attributes

**public Wire\_number**

The wire\_number specifies the identification of a wire. This number is unique within a vehicle and usually automatically generated (dependent on "from- to" information).

Note: Each interior conductor of a multi-core wire produces an own wire number.

### Associations

**Part: Core [1]**

The part specifies the Core that serves as a definition for this particular occurrence.

**Length\_information: Wire\_length [1..\*]**

The length\_information specifies the length of a Core\_occurrence. For a core, as many Wire\_length objects as required may be defined. There are two pre-defined types:

- DMU: By CAD model calculated wire length. Usually it is the Sum of the lengths of neutral fibers of the bundle sections, normally too short.
- Manufacturing: determination by means of correction algorithms or measurement of the prototype.

**Class: Fixing\_occurrence**

A Fixing\_occurrence is the occurrence of a Fixing in a module part list.

**Attributes**

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Fixing\_occurrence.

**public Description [0..1]**

The description specifies additional information about the object.

**public Id**

The id specifies the identifier of the Fixing\_occurrence.

**public Placement [0..1]**

The placement specifies the transformation information, which is used to locate and orient the occurrence in the car coordinate system. For further information see [CESAK].

**Associations**

**Part: Fixing [1]**

The part specifies the Fixing that serves as a definition for this particular occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Fixing\_occurrence.

**Class: General\_wire\_occurrence**

A General\_wire\_occurrence is the occurrence of a Wire\_occurrence or a Special\_wire\_occurrence in a module part list.

**Associations**

**Part: General\_wire [1]**

The part specifies the General\_wire that serves as a definition for this particular occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Connection.

**Length\_information: Wire\_length [1..\*]**

The length\_information specifies the length of a General\_wire\_occurrence. For a wire, as many Wire\_length objects as required may be defined. There are two pre-defined types:

- DMU: By CAD model calculated wire length. Usually it is the Sum of the lengths of neutral fibers of the bundle sections, normally too short.
  - Manufacturing: determination by means of correction algorithms or measurement of the prototype.
- There shall be at least one Wire\_length of type DMU be defined for each wire.

**Class: Mounting\_element**

A Mounting\_element is an object which is associated with a Component\_occurrence.

**Class: Part\_substitution**

Austauschbauteil

A Part\_substitution is a mechanism that describes the replacement of a sealing plug with a terminal. Typically usage: an optional module is added to a harness and a common connector will be used.

### Associations

**Replaced: Cavity\_plug\_occurrence [1]**

The replaced specifies the Cavity\_plug\_occurrence, that is replaced.

### Class: Part\_usage\_select

A Part\_usage is an object which replaces a Cavity\_occurrence.

### Associations

**Replacing: Part\_substitution [0..\*]**

### Class: Special\_terminal\_occurrence

A Special\_terminal\_occurrence is the occurrence of a General\_terminal with an identifier in a module part list.

### Attributes

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Special\_terminal\_occurrence

**public Description [0..1]**

The description specifies additional information about the object.

**public Id**

The id specifies the identifier of the Special\_terminal\_occurrence.

**public Placement [0..1]**

The placement specifies the transformation information, which is used to locate and orient the occurrence in the car coordinate system. For further information see [CESAK].

### Associations

**Part: General\_terminal [1]**

The part specifies the General\_terminal that serves as a definition for this particular occurrence.

**Installation\_information: Installation\_instruction [0..\*]**

The installation\_information provides additional information for the installation of the Special\_terminal\_occurrence.

### Class: Special\_wire\_occurrence

Mehrdrahtleitung

A Special\_wire\_occurrence is the occurrence of a multi-core wire in a module part list.

### Attributes

**public Special\_wire\_id**

A special\_wire\_id specifies the identifier of the individual occurrence of multi-core wire. In contrast to the occurrence of a single wire which do not need to be identified in the module part list, each multi-core wire occurrence must be identified.

### Associations

**Core\_occurrence: Core\_occurrence [0..\*]**

The core\_occurrence specifies the Core\_occurrence contained in the Special\_wire\_occurrence.

### Class: Specified\_accessory\_occurrence

A Specified\_accessory\_occurrence is the occurrence of a accessory\_occurrence within an Assembly\_part\_occurrence.

### Associations

**Related\_occurrence: Accessory\_occurrence [1]**

The related\_occurrence specifies the Accessory\_occurrence it is an occurrence of.

**Related\_assembly: Assembly\_part\_occurrence [1]**

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Class: Specified\_cavity\_plug\_occurrence

A Specified\_cavity\_plug\_occurrence is the occurrence of Cavity\_plug\_occurrence within an Assembly\_part\_occurrence.

### Associations

**Related\_assembly: Assembly\_part\_occurrence [1]**

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

**Related\_occurrence: Cavity\_plug\_occurrence [1]**

The related\_occurrence specifies the Cavity\_plug\_occurrence it is an occurrence of.

### Class: Specified\_cavity\_seal\_occurrence

A Specified\_cavity\_seal\_occurrence is the occurrence of a Cavity\_seal\_occurrence within an Assembly\_part\_occurrence.

### Associations

**Related\_assembly: Assembly\_part\_occurrence [1]**

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

**Related\_occurrence: Cavity\_seal\_occurrence [1]**

The related\_occurrence specifies the Cavity\_seal\_occurrence it is an occurrence of.

### Class: Specified\_co\_pack\_occurrence

A Specified\_co\_pack\_occurrence is the occurrence of a Co\_pack\_occurrence within an Assembly\_part\_occurrence.

### Associations

**Related\_assembly: Assembly\_part\_occurrence [1]**

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

**Related\_occurrence: Co\_pack\_occurrence [1]**

The related\_occurrence specifies the Co\_pack\_occurrence it is an occurrence of.

### Class: Specified\_component\_occurrence

A Specified\_component\_occurrence is the occurrence of a Component within an Assembly\_part\_occurrence.

### Associations

**Related\_assembly: Assembly\_part\_occurrence [1]**

**Related\_occurrence: Component\_occurrence [1]**

### Class: Specified\_connector\_occurrence

A Specified\_connector\_occurrence is the occurrence of a Connector\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Connector\_occurrence [1]

The related\_occurrence specifies the Connector\_occurrence it is an occurrence of.

## Class: Specified\_fixing\_occurrence

A Specified\_fixing\_occurrence is the occurrence of a Fixing\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Fixing\_occurrence [1]

The related\_occurrence specifies the Fixing\_occurrence it is an occurrence of.

## Class: Specified\_special\_terminal\_occurrence

A Specified\_special\_terminal\_occurrence is the occurrence of a Special\_terminal\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Special\_terminal\_occurrence [1]

The related\_occurrence specifies the Special\_terminal\_occurrence it is an occurrence of.

## Class: Specified\_special\_wire\_occurrence

A Specified\_special\_wire\_occurrence is the occurrence of a Special\_wire\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Special\_wire\_occurrence [1]

The related\_occurrence specifies the Special\_wire\_occurrence it is an occurrence of.

## Class: Specified\_terminal\_occurrence

A Specified\_terminal\_occurrence is the occurrence of a Terminal\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Terminal\_occurrence [1]

The related\_occurrence specifies the Terminal\_occurrence it is an occurrence of.

## Class: Specified\_wire\_occurrence

A Specified\_wire\_occurrence is the occurrence of a Wire\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Wire\_occurrence [1]

The related\_occurrence specifies the Wire\_occurrence it is an occurrence of.

## Class: Specified\_wire\_protection\_occurrence

A Specified\_wire\_protection\_occurrence is the occurrence of a Wire\_protection\_occurrence within an Assembly\_part\_occurrence.

## Associations

### Related\_assembly: Assembly\_part\_occurrence [1]

The related\_assembly specifies the Assembly\_part\_occurrence in which the occurrence is used.

### Related\_occurrence: Wire\_protection\_occurrence [1]

The related\_occurrence specifies the Wire\_protection\_occurrence it is an occurrence of.

## Class: Terminal\_occurrence

A Terminal\_occurrence is the occurrence of a General\_terminal in a module part list.

Note: The number of occurrences used in a specific module or harness can be calculated by the individual occurrences.

Note: The usage of a Terminal\_occurrence for a particular Cavity is specified by the Part\_usage object.

## Associations

### Part: General\_terminal [1]

The part specifies the General\_terminal that serves as a definition for this particular occurrence.

## Class: Wire\_occurrence

A Wire\_occurrence is the occurrence of a single wire in a module part list.

## Attributes

### public Wire\_number

The wire\_number specifies the identification of a wire. This number is unique within a vehicle and usually automatically generated (dependent on "from-to" information).

## Class: Wire\_protection\_occurrence

A Wire\_protection\_occurrence is the occurrence of a Wire\_protection in a module part list.

## Attributes

### public Alias\_id [0..\*]

The alias\_id specifies additional identifiers for the Wire\_protection\_occurrence.

### public Description [0..1]

The description specifies additional information about the object.

### public Id

The id specifies the identifier of the Wire\_protection.

### public Protection\_length [0..1]

The protection\_length specifies the length of the Wire\_protection\_occurrence with respect to the wrapping.

Note: The protection\_length may differ from the real length of the material. E.g. for a tube, the protection\_length and the real length are same, whereas for a tape they are different.

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## Associations

### Installation\_information: Installation\_instruction [0..\*]

The installation\_information provides additional information for the installation of the Wire\_protection\_occurrence.

### Part: Wire\_protection [1]

The part specifies the Wire\_protection that serves as a definition for this particular occurrence.

## Package: ::KBL::4\_Connectivity

This concept specifies the concepts required to specify the connectivity among the connectors within a harness. The specification of contact points and wiring groups are included.

## Classes

### Class: Cavity\_occurrence

A Cavity\_occurrence is the occurrence of a Cavity in the context of a connector\_occurrence.

#### Associations

##### Part: Cavity [1]

The part specifies the Cavity that serves as a definition for this particular occurrence.

##### Associated\_plug : Cavity\_plug\_occurrence [0..1]

The associated\_plug specifies the plug the cavity is equipped with.

### Class: Connection

Verbindung

A Connection is a mechanism to specify the electrical connectivity between two or more contact points.

#### Attributes

##### public Description [0..1]

The description specifies additional information about the object.

##### public Id [0..1]

The id specifies the identifier of the Connectivity. The values are company specific. They can depend also on wire parameters.

Example: electrical potential, start->destination

##### public Signal\_name [0..1]

The signal\_name specifies logical information on a Connection.

Example: packet on a bus, analogue voltage(high/low, waved) on a wire.

#### Associations

##### External\_references: External\_reference [0..\*]

The external\_references specifies references to documents.

Example: Schematic diagram for the connection.

##### Extremities: Extremity [2..\*]

The extremities specify Extremity objects, which reference the Contact\_points connected by this Connection. There shall be at least two objects specified.

##### Installation\_information: Installation\_instruction [0..\*]

The installation\_information provides additional information for the installation of the Connection.

##### Processing\_information: Processing\_instruction [0..\*]

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The processing\_information provides additional information for the processing of the Connection.

**Wire: Wire\_or\_core\_occurrence [1]**

The wire specifies the Wire\_occurrence or Core\_occurrence which realizes the Connection.

**Class: Contact\_point**

A Contact\_point defines the positions where electrical connectivity takes place.

**Attributes**

**public Id**

The id specifies the identifier of the Contact\_point.

**Associations**

**Contacted\_cavity: Cavity\_occurrence [1..\*]**

The contacted\_cavity specifies the Cavity\_objects related with the Contact\_point.

**Associated\_parts: Part\_usage\_select [0..\*]**

The associated\_parts specifies the Cavity\_seal\_occurrences, Special\_terminal\_occurrences, or Terminal\_occurrences associated with the Contact\_point.

**Class: Extremity**

The Extremity specifies the Contact\_point which is connected by a specific Connection.

**Attributes**

**public Position\_on\_wire**

The Position\_on\_wire describes the position where the contacting takes place. That is important for contacts like IDC, where the contacting is not at the beginning or end of the wire.

Note: A value of 0.0 designates the beginning of the wire, a value of 1.0 the end. Intermediate contact\_points are defined relative to the first one by a value between 0.0 and 1.0.

The position\_on\_wire defines the ordering of the Extremities within a Connection.

**Associations**

**Contact\_point: Contact\_point [1]**

The contact\_point specifies the Contact\_point, which is associated with the Extremity, and by this with the connection.

**Class: Slot\_occurrence**

A Slot\_occurrence is the occurrence of a Slot in a module part list.

**Associations**

**Cavities: Cavity\_occurrence [1..\*]**

The cavities specifies the Cavity\_occurrence objects belonging to the Slot\_occurrence.

**Part: Slot [1]**

The part specifies the Slot that serves as a definition for this particular occurrence.

**Class: Wire\_or\_core\_occurrence**

A Wire\_or\_core\_occurrence is an occurrence of a single wire, a multi-core wire, or a individual core of a multi-core wire.

**Class: Wiring\_group**

A Wiring\_group is a mechanism to group wire or core occurrences together.

Example: Twisted pairs.

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## Attributes

### public Id

The id specifies the identifier of the Wiring\_group.

### public Type [0..1]

The type specifies the type of the grouping.

Example: twisted-pair.

## Associations

### Processing\_information: Processing\_instruction [0..\*]

The processing\_information provides additional information for the processing of the Wiring\_group.

### Assigned\_wire: Wire\_or\_core\_occurrence [2..\*]

The assigned\_wire specifies the Wire\_occurrence and Core\_occurrence objects which are grouped together.

# Package: ::KBL::5\_Topology

This package specifies the information contained in harness layouts and drawings. This includes the geometric description of bundles and the information how a specific wire is routed.

## Classes

### Class: Dimension\_specification

A Dimension\_specification is the definition of the distance between two elements.

#### Associations

##### target: Placed\_element [1]

The target specifies the Node or the located component that is the target for the Dimension\_specification.

##### origin: Placed\_element [1]

The origin specifies the Node or the located component that is the origin for the Dimension\_specification.

##### Tolerance\_indication: Tolerance [0..1]

The Tolerance\_indication specifies the value of the distance between the two elements.

### Class: Fixed\_component

A Fixed\_component is an object that can be assigned by a fixing.

### Class: Fixing\_assignment

A Fixing\_assignment assigns a Fixing\_occurrence or an Accessory\_occurrence to a Segment.

#### Attributes

##### public Location

The location specifies the position of the fixing on the Segment. The value is given in curve parameters running from 0.0 to 1.0.

##### public Orientation [2..3]

The orientation specifies the direction of the z-axis and is given by 2 or 3 values. The y-axis is defined by the tangent of the center curve at the location.

#### Associations

##### Fixing: Fixed\_component [1]

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The fixing specifies the Fixing\_occurrence or the Accessory\_occurrence, which is assigned.

## Class: Located\_component

Positionierbare Komponenten der KBL: z.B. Connector\_occurrence, Accessory\_occurrence, Fixing\_occurrence, ...

A Located\_component is a component which can get a position in the topology by a node.

## Class: Node

A node forms begin and end of a Segment.

### Attributes

#### public Alias\_id [0..\*]

The alias\_id specifies additional identifiers for the Node.

Example: Node Ids may vary from one CAD system export to another.

Therefore the CAD system Id is improper for Id attribute. Id shall have a value which is unique within the harness. Alias\_id may be used for the CAD system Id.

#### public Bend\_radius [0..1]

The bend\_radius specifies the maximum bend radius at the Node.

Example: May be used for the routing of fibre-optics.

#### public Id

The id specifies the identifier of the Node.

### Associations

#### Cartesian\_point: Cartesian\_point [1]

The cartesian\_point specifies the position of the Node with respect to the absolute car coordinate system.

#### referenced\_components: Located\_component [0..\*]

The referenced\_components specifies the Accessory\_occurrences, Assembly\_part\_occurrences, Connector\_occurrences, Fixing\_occurrences, Special\_terminal\_occurrences, and Wire\_protection\_occurrences located at the node.

Note: Different elements can lead to a node, e.g. plug, Splice, perhaps clip.

#### Processing\_information: Processing\_instruction [0..\*]

The processing\_information provides additional information for the processing of the Node.

## Class: Placed\_element

A Placed\_element is an element where a Dimension\_specification can apply.

## Class: Protection\_area

Schutzzone

A Protection\_area is a mechanism to describe the area on a Segment covered by a Wire\_protection\_occurrence. Some segments of a harness are crossing areas with critical conditions like higher temperatures, higher humidity, etc. To prevent the damage of the cable, protect shields are mounted for that segment.

Note: For each Segment covered by a particular Wire\_protection\_occurrence a separate Protection\_area has to be instantiated.

### Attributes

#### public End\_location

The end\_location specifies the end position of the Wire\_protection\_occurrence on the Segment. The value is given in curve parameters running from 0.0 to 1.0.

#### public Gradient [0..1]

The gradient specifies the gradient of the protection.

Note: The gradient is defined in mm. Gradient 15 mms means that the winding screws within a turn 15 mms along the bundle.

**public Start\_location**

The start\_location specifies the start position of the Wire\_protection\_occurrence on the Segment. The value is given in curve parameters running from 0.0 to 1.0.

**public Taping\_direction [0..1]**

The taping\_direction specifies the direction of the taping (left/right) regarding to the Segment direction.

**Associations**

**Processing\_information: Processing\_instruction [0..\*]**

The processing\_information provides additional information for the processing of the Protection\_area.

**Associated\_protection: Wire\_protection\_occurrence [1]**

The associated\_protection specifies the Wire\_protection\_occurrence associated Segment objects.

**Class: Routing**

A Routing is a course taken to get from a starting point to a destination.

**Associations**

**Routed\_wire: Connection [1]**

The routed\_wire specifies the Connection for which the Routing is defined.

**Segments: Segment [0..\*]**

The segments specifies the Segment objects the course follows.

**Class: Segment**

Verbindungsabschnitt

A Segment is a section of a Connection where no intermediate electrical contacts appear. At the beginning and at the end the same wires go in and out. Cables and wires are divided in segments. Every segment has its conditions like length, temperature range, etc.

**Attributes**

**public Alias\_id [0..\*]**

The alias\_id specifies additional identifiers for the Segment.

Example: Segement Ids may vary from one CAD system export to another.

Therefore the CAD system Id is improper for Id attribute. Id shall have a value which is unique within the harness. Alias\_id may be used for the CAD system Id.

**public End\_vector [0..3]**

The end\_vector specifies the tangent of the center curve at the end position.

Note: The value can be derived from the center\_curve. To avoid that the receiving system has to calculate the value, it can be explicitly specified.

**public Form [0..1]**

The form specifies information on the geometric shape of the Segment.

The following values shall be used:

- 'circular'
- 'noncircular'

**public Id**

The id specifies the identifier of the Segment.

**public Physical\_length [0..1]**

The physical\_length specifies the arc length of the neutral phase of the segment in 3d.

**public Start\_vector [0..3]**

The start\_vector specifies the tangent of the center curve at the start position.

Note: The value can be derived from the center\_curve. To avoid that the receiving system has to calculate the value, it can be explicitly specified.

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**public Virtual\_length [0..1]**

The virtual\_length specifies the represented length of the neutral phase of the segment in 3d.

**Associations**

**Center\_curve: B\_spline\_curve [0..\*]**

The center\_curve specifies the mathematical definition of the set of center curves of the Segment.

**Cross\_section\_area\_information: Cross\_section\_area [0..\*]**

The cross\_section\_area\_information specifies the cross-sectional area of the route.

Note: This information is needed for noncircular Segments.

**Fixing\_assignment : Fixing\_assignment [0..\*]**

The fixing\_assignment specifies the Fixing\_assignment objects associated with the Segment.

**End\_node: Node [1]**

The end\_node specifies the Node defining the end of the Segment.

**Start\_node: Node [1]**

The start\_node specifies the Node defining the start of the Segment.

**Protection\_area: Protection\_area [0..\*]**

The Protection\_area specifies the Protection\_area objects associated with the Segment.

**Class: Segment\_form**

**Attributes**

**public circular**

**public noncircular**

**Class: Tolerance**

A Tolerance is the specification of the allowable range for a dimension.

**Attributes**

**public Lower\_limit [0..1]**

The lower\_limit specifies the minimum allowed value.

**public Upper\_limit [0..1]**

The upper\_limit specifies the maximum allowed value.

**Package: ::KBL::6\_Foundation**

This packages contains the basic classes for the KBL like numerical values, units, materials and also more complex descriptions like change information.

**Classes**

**Class: Alias\_identification**

Alternative Identifikation

An Alias\_identification is a mechanism to associate an object with an additional identifier that is used to identify the object of interest in a different context, either in another Organization, or in some other context. The scope of the Alias\_identification shall be specified by the attributes 'Scope' and/or by the attribute 'Description'.

**Attributes**

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**public Alias\_id**

The alias\_id specifies the identifier used in the context specified by scope and description.

**public Description [0..1]**

The description specifies the type of the Alias\_identification.

Example: The description may be, e.g., 'inventory number'.

**public Scope [0..1]**

The scope specifies the organization in which the Alias\_identification is valid.

## Class: Approval

An Approval is a judgment concerning the quality of those modules or harnesses that are subject of the Approval. An Approval represents a statement made by technical personnel or management personnel whether certain requirements are met. The absence of approval information does not imply any approval status by default.

### Attributes

**public Date**

The date specifies the date when the Approval actually became valid.

**public Department [0..1]**

The department specifies the department name of the personnel responsible for the Approval.

**public Name [0..1]**

The name specifies the name of the personnel responsible for the Approval.

**public Type\_of\_approval**

The type\_of\_approval specifies the terms characterizing the Approval.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

### Associations

**Is\_applied\_to: Part\_with\_title\_block [1..\*]**

The is\_applied\_to specifies the hobjects to which the Approval is assigned.

## Class: B\_spline\_curve

A B-spline curve is a piecewise parametric polynomial or rational curve described in terms of control points and basis functions. The B-spline curve has been selected as the most stable format to represent all types of polynomial or rational parametric curves. With appropriate attribute values it is capable of representing single span or spline curves of explicit polynomial, rational, Bezier or B-spline type.

Within the Harness Engineering Information Model the definition has been restricted to a uniform B\_spline\_curve, where the knots are evenly spaced. Suitable default values for the knots and knot multiplicities are derived in this case. A B-spline is uniform if and only if all knots are of multiplicity 1 and they differ by a positive constant from the preceding knot. In this case the knot spacing is 1.0, starting at -d , where d is the degree.

Note: If the B-spline curve is uniform and degree=1, the B-spline is equivalent to a polyline.

### Attributes

**public Degree**

The algebraic degree of the basis functions.

### Associations

**Control\_points: Cartesian\_point [2..\*]**

The list of control points for the curve.

The list shall contain at least 2 elements.

## Class: Cartesian\_point

A Cartesian\_point is a point that is defined by its coordinates in a rectangular Cartesian coordinate sys-

tem.

### Attributes

#### public Coordinates [2..3]

The coordinates specify the coordinates of the Cartesian\_point. The third coordinate will not exist in the case of a two-dimensional point.

### Class: Change

A Change is a mechanism to keep track of the change history. The set of changes assigned to a Part covers all modification numbers up to the last modification level of the version of the Part.

### Attributes

#### public Approver\_department [0..1]

The approver\_department specifies the department of the personnel who approved the Part.

#### public Approver\_name [0..1]

The approver\_name specifies the name of the personnel who approved the Part.

#### public Change\_date [0..1]

The change\_date specifies the date the change was performed.

#### public Change\_request [0..1]

The change\_request specifies the activity which triggers one or more changes.  
Example: change request, AEKO, VV; "Modellpflegepunkt"

#### public Description [0..1]

The description specifies additional information about the change.

#### public Designer\_department

The designer\_department specifies the department of the responsible design engineer.

#### public Id [0..1]

The id specifies the identifier by which a certain change can be referenced.  
Example: reference of a fax, note, etc.

#### public Responsible\_designer

The responsible\_designer specifies the responsible design engineer.

### Class: Creation

A Creation assigns creation information to a Module or Harness.

### Attributes

#### public Date

The date specifies the creation date.

#### public Department

The department specifies the department the creator belongs to.

#### public Name

The name specifies the name of the creator.

### Associations

#### Is\_applied\_to: Part\_with\_title\_block [1..\*]

The is\_applied\_to specifies the harness or module objects to which the Creation is assigned.

### Class: Cross\_section\_area

A Cross\_section\_area

### Attributes

#### public Area

The area specifies the value of the Cross\_section\_area.

**public Value\_determination**

The value\_determinates specifies whether the value is calculated, reserved, or measured.

**Class: External\_reference**

An External\_reference is a mechanism to provide information of the documents associated with the Part. Example: 3D model, form board drawings, etc.

**Attributes**

**public Change\_level**

The change\_level specifies the version of the document.

**public Creating\_system [0..1]**

The creating\_system specifies the computer application or the machine which is used to create the document.

**public Data\_format**

The data\_format specifies the convention that was used to structure the information in the document.

**public Document\_number**

The document\_number specifies the identifier of the document.

**public Document\_type**

The document\_type specifies the kind of the document.

Where applicable the following values shall be used:

- 3D-Data set (wiring, construction unit)
- 2D-Data set (Ltgs design, symbol, plug face)
- cable connection diagram
- set of cables database (VW: LCS-Container)
- specification of set of cables
- standards, technical guidelines

**public File\_name [0..1]**

The file\_name specifies the name which is used to locate the file either on a computer system or in a repository of paper documents.

**public Location [0..1]**

The location specifies where a document can be found in a digital or physical data storage system.

**Class: Installation\_instruction**

An Installation\_instruction is the description of the methods that can be used to install a Part.

**Attributes**

**public Instruction\_type**

**public Instruction\_value**

The instruction\_value specifies the value for the kind of the Installation\_instruction defined by instruction\_type.

**Class: Material**

A Material is the substance out of which a Part is or can be made.

**Attributes**

**public Material\_key**

The material\_key specifies a code by which the material can be identified.

**public Material\_reference\_system [0..1]**

The material\_reference\_system specifies the system in which the material\_key and its meaning is defined.

Example: 'IMDS' for the International Material Database System.

## Class: Numerical\_value

A Numerical\_value is a quantity expressed with a numerical value and a unit.

### Attributes

#### public Value\_component

The value\_component specifies the quantity of the Numerical\_value.

## Class: Processing\_instruction

A Processing\_instruction is the description of the methods that can be used to process a Part.

### Attributes

#### public Instruction\_type

The instruction\_type specifies the kind of the Processing\_instruction.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

#### public Instruction\_value

The instruction\_value specifies the value for the kind of the Processing\_instruction defined by instruction\_type.

## Class: SI\_prefix

### Attributes

#### public centi

#### public kilo

#### public micro

#### public milli

### Associations

: Unit [1]

## Class: SI\_unit\_name

### Attributes

#### public gram

#### public metre

### Associations

: Unit [1]

## Class: Transformation

A Transformation is a geometric transformation composed of translation and rotation. Scaling is not included.

### Attributes

#### public U [2..3]

The u specifies the rotation by means of the y-axis.

#### public V [2..3]

The v specifies the rotation by means of the z-axis.

## Associations

### Cartesian\_point: Cartesian\_point [1]

The cartesian\_point specifies the coordinates of the translation.

## Class: Unit

A Unit is a quantity chosen as a standard in terms of which other quantities may be expressed.

Example: A unit of square milli metre is defined as a SI\_unit with Si\_unit\_name "metre", Si\_prefix "milli" and Si\_dimension "square".

### Attributes

#### public Si\_dimension [0..1]

The Dimension specifies the dimension of a SI\_unit.

Example: "square", "cubic".

#### public Si\_prefix [0..1]

The si\_prefix specifies the prefix for a SI unit.

Example: 'milli', 'kilo'

#### public Si\_unit\_name [0..1]

The si\_unit\_name specifies the name for a SI unit.

Example: 'gram', 'metre'

#### public Unit\_name [0..1]

The unit\_name specifies the name for a non SI unit.

Note: This attribute shall be used to specify units like 'kg/100 pieces'

## Class: Unit\_dimension

### Attributes

public cubic

public square

## Class: Value\_determination

### Attributes

public calculated

public measured

public reserved

## Class: Value\_range

A Value\_range is a pair of numerical values representing the range in which the value shall lie.

### Attributes

public Maximum

The maximum specifies the maximum acceptable value that is constrained by the Value\_range.

public Minimum

The minimum specifies the minimum acceptable value that is constrained by the Value\_range.

## Class: Value\_with\_unit

A Value\_with\_unit is either a single numerical measure, or a range of numerical measures with upper, lower, or upper and lower bounds.

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## Associations

### Unit\_component: Unit [1]

The unit\_component specifies the unit in which the Value\_with\_unit is expressed.

## Class: Wire\_colour

A Wire\_colour is a mechanism to define a colour for a wire together with a description of the kind of the colour.

### Attributes

#### public Colour\_type

The colour\_type specifies the type of the colour.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

Example: 'base colour', 'second', 'third'

#### public Colour\_value

The colour\_value specifies the value of the colour.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

Example: 'red'

## Class: Wire\_length

Kabellänge

A Wire\_length is a mechanism to define a length for a wire together with a description of the kind of the length (e.g. for DMU, for manufacturing).

### Attributes

#### public Length\_type

The length\_type specifies the type of the length.

Note: There are no values pre-defined. Special values have to be negotiated between exchange partners.

#### public Length\_value

The length\_value specifies the length of the wire.

## Package: ::KBL::A\_Diagrams

## Diagrams

### Diagram: (00) Connection Overview

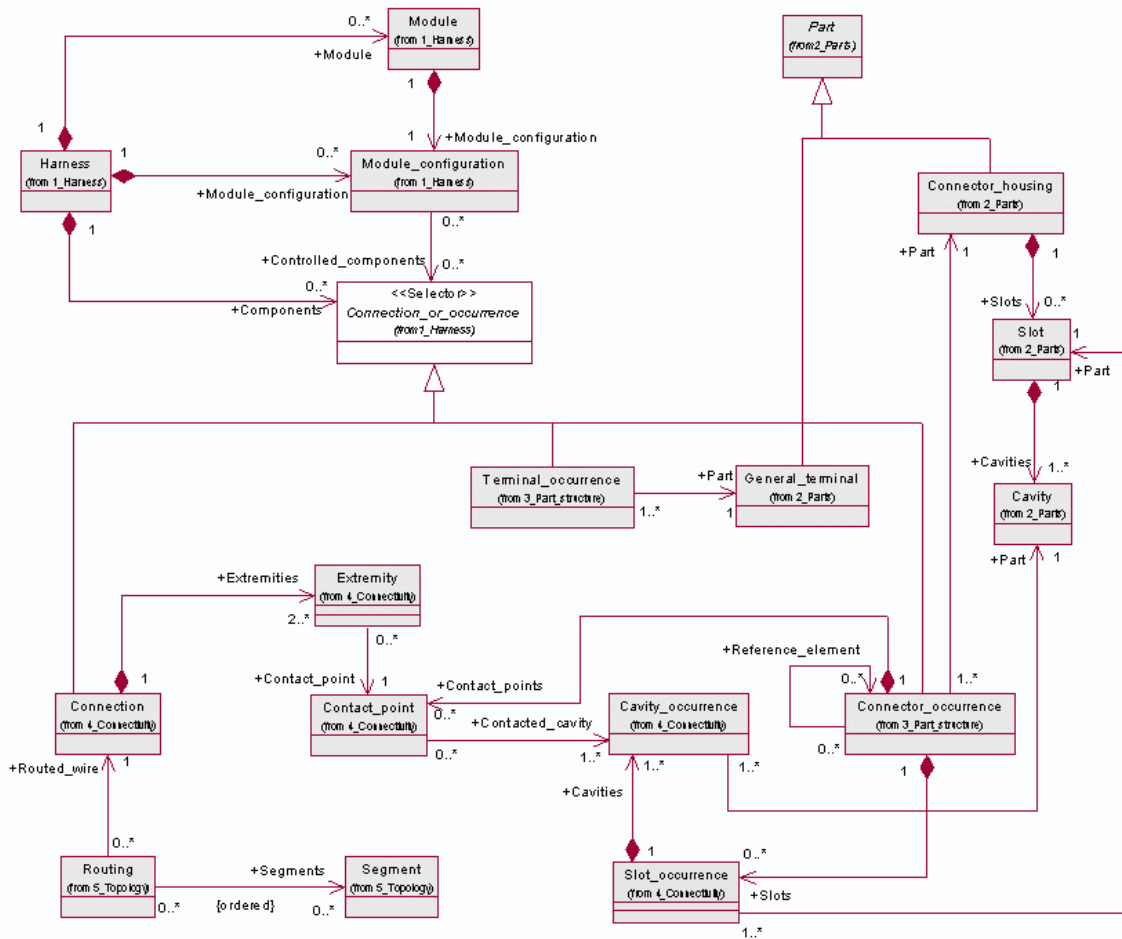


Diagram: (00) Connection Overview

Diagram: (01) Common part attributes and properties

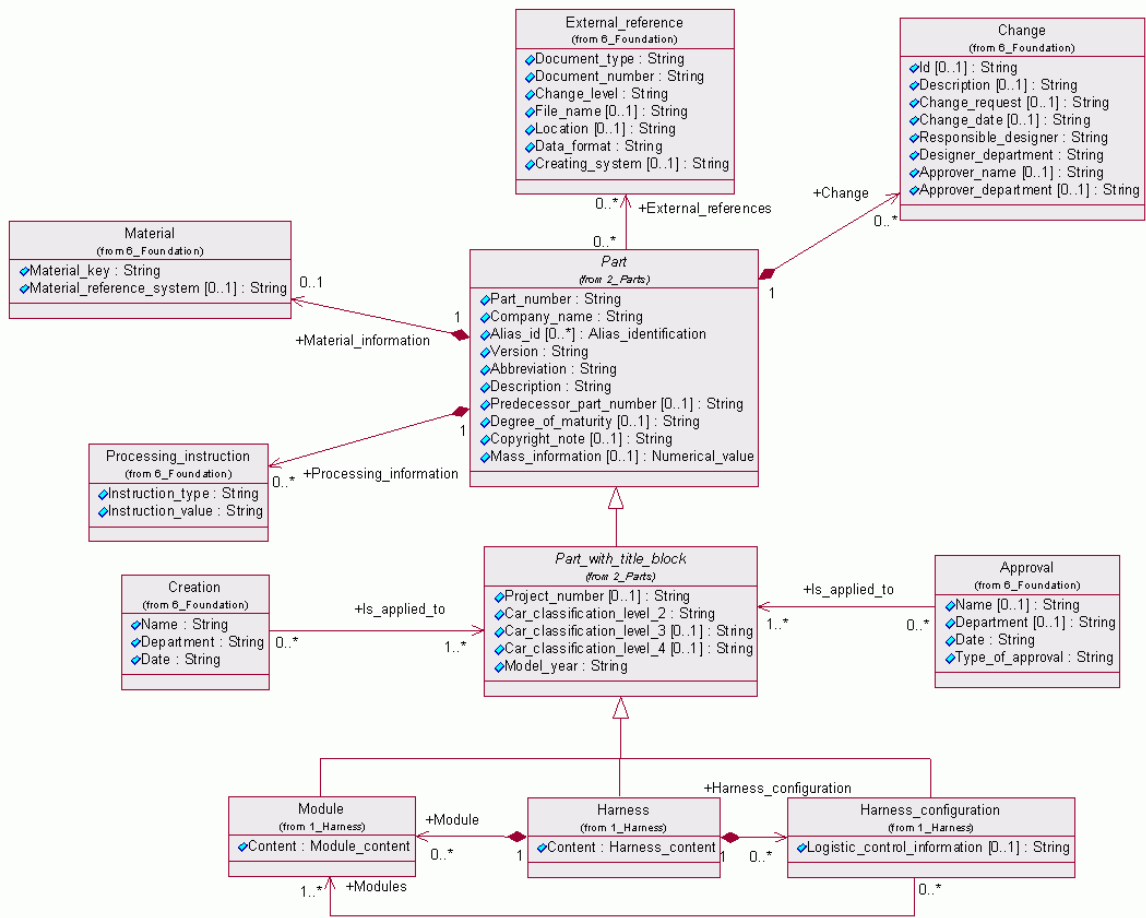


Diagram: (01) Common part attributes and properties

Diagram: (02) Part specializations

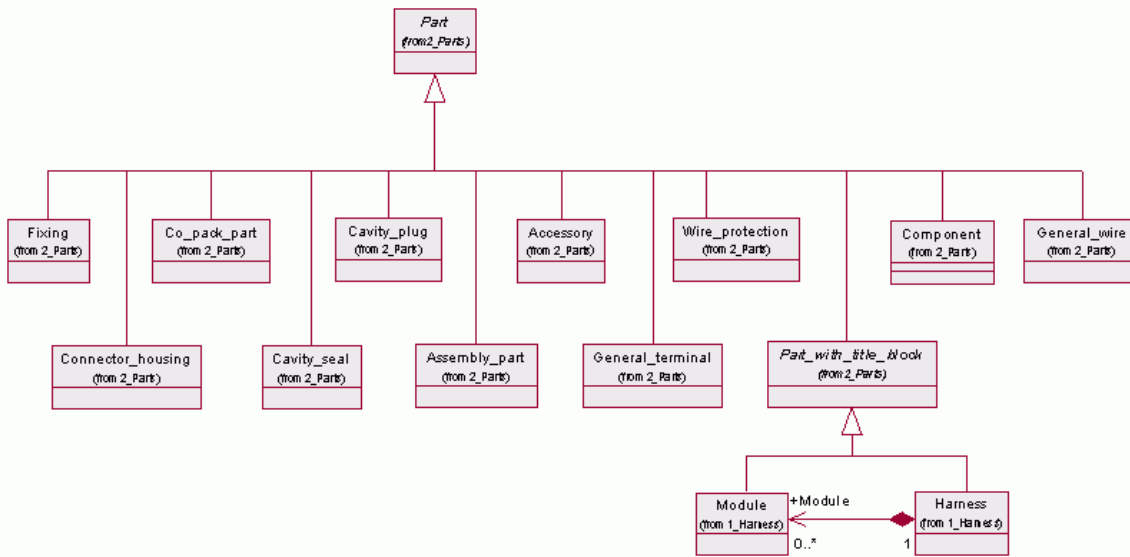


Diagram: (02) Part specializations

### Diagram: (03) Harness and Modules



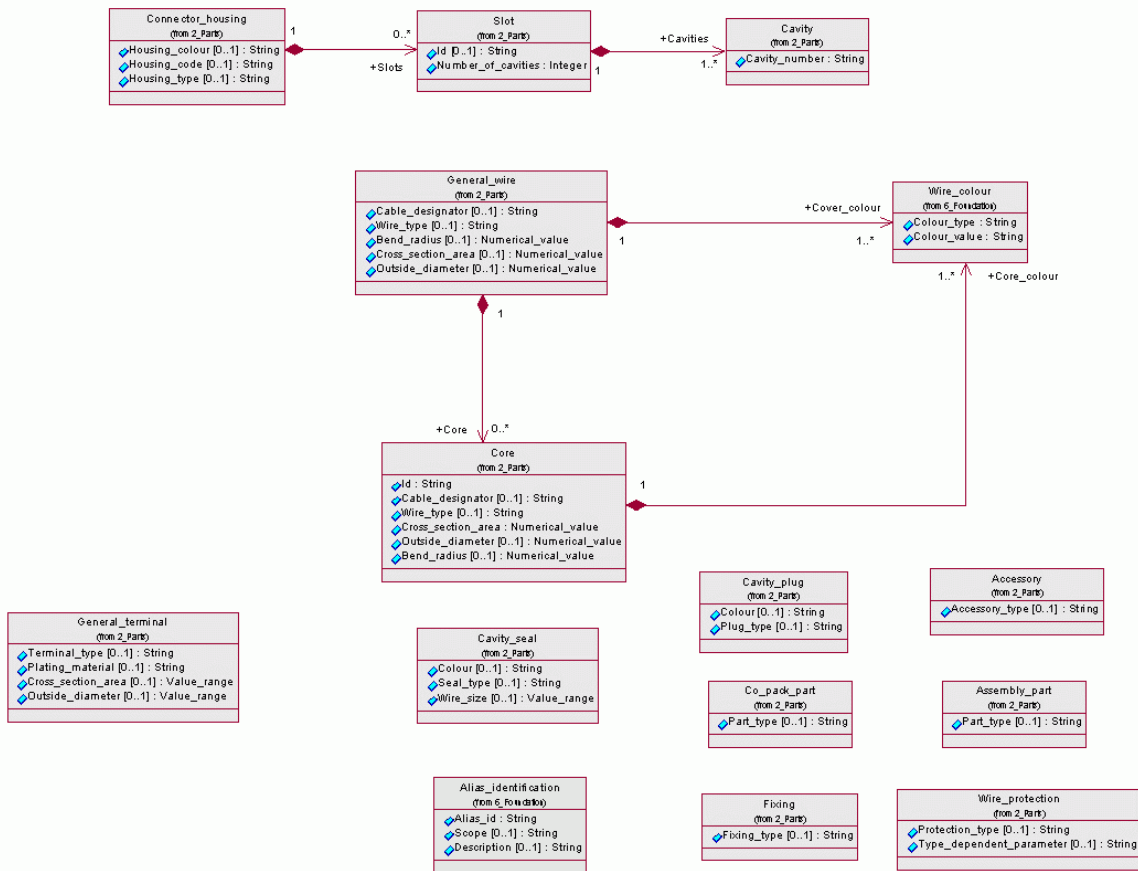


Diagram: (04) Part master data

### Diagram: (05) Connectivity

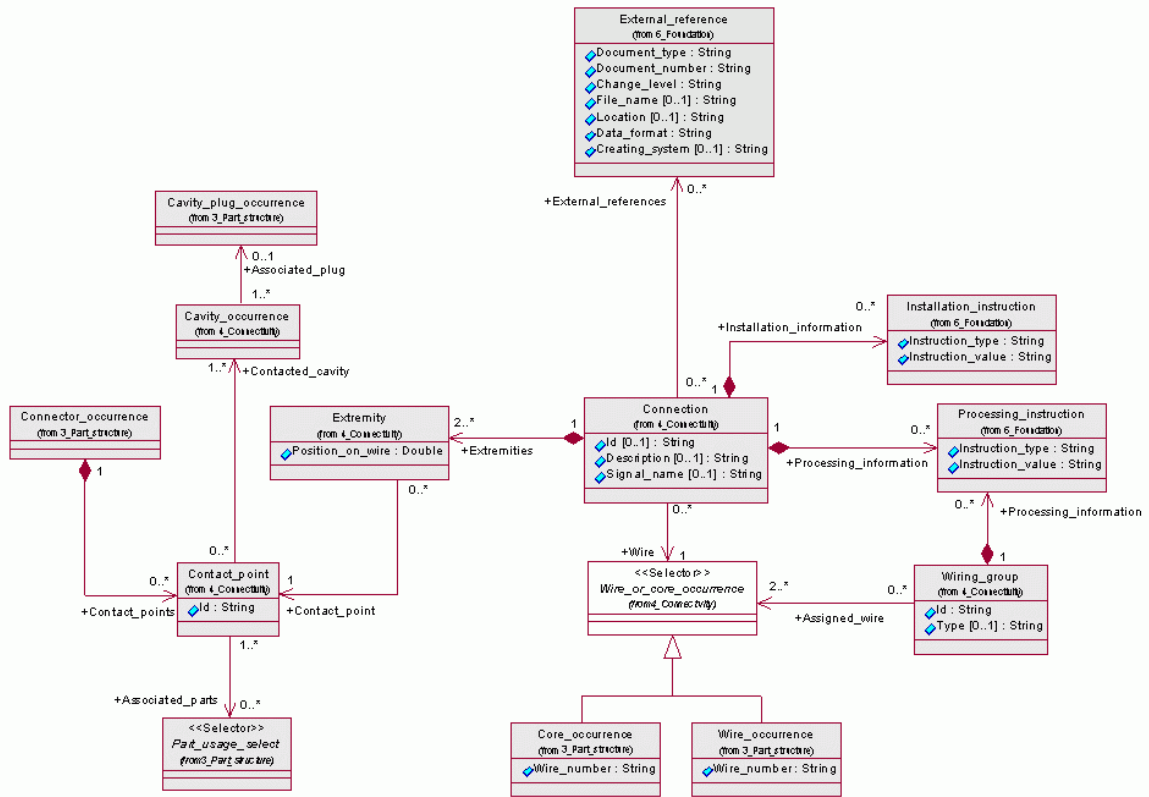


Diagram: (05) Connectivity

Diagram: (06) Part usage list (1)

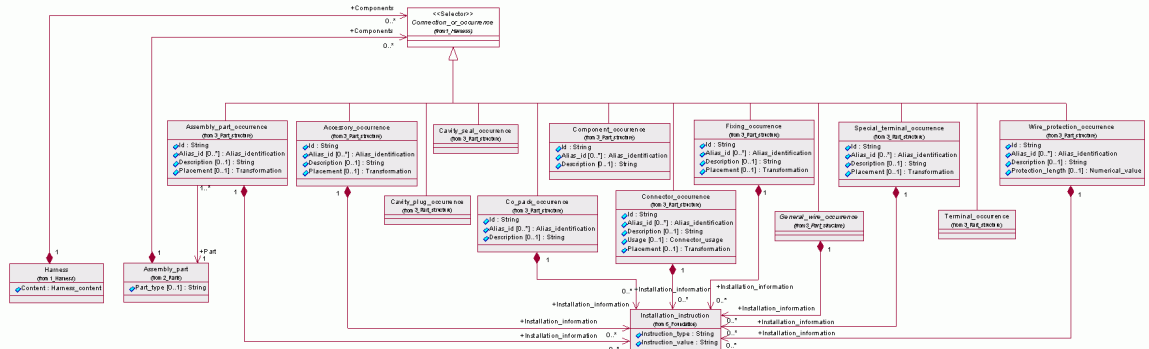


Diagram: (06) Part usage list (1)

Diagram: (07) Part usage list (2)

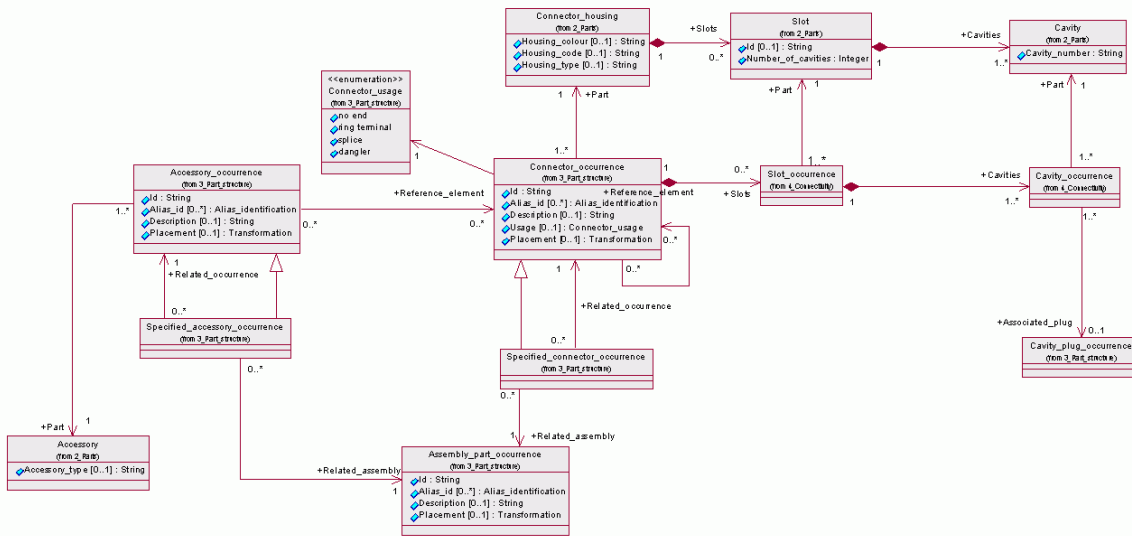


Diagram: (07) Part usage list (2)

Diagram: (08) Part usage list (3)

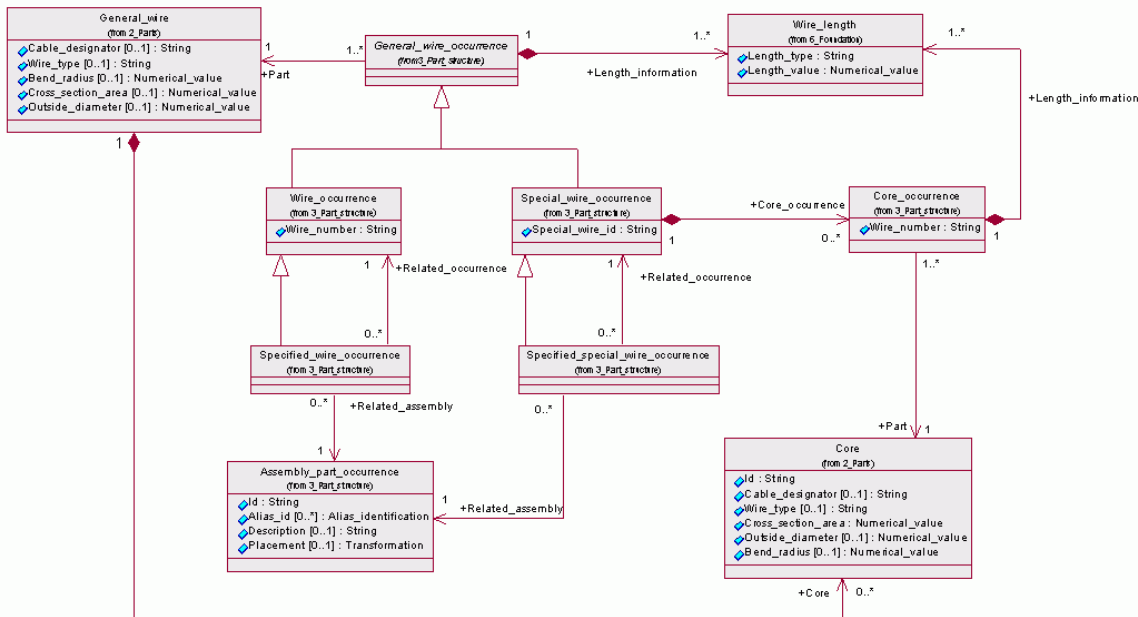


Diagram: (08) Part usage list (3)

Diagram: (09) Part usage list (4)

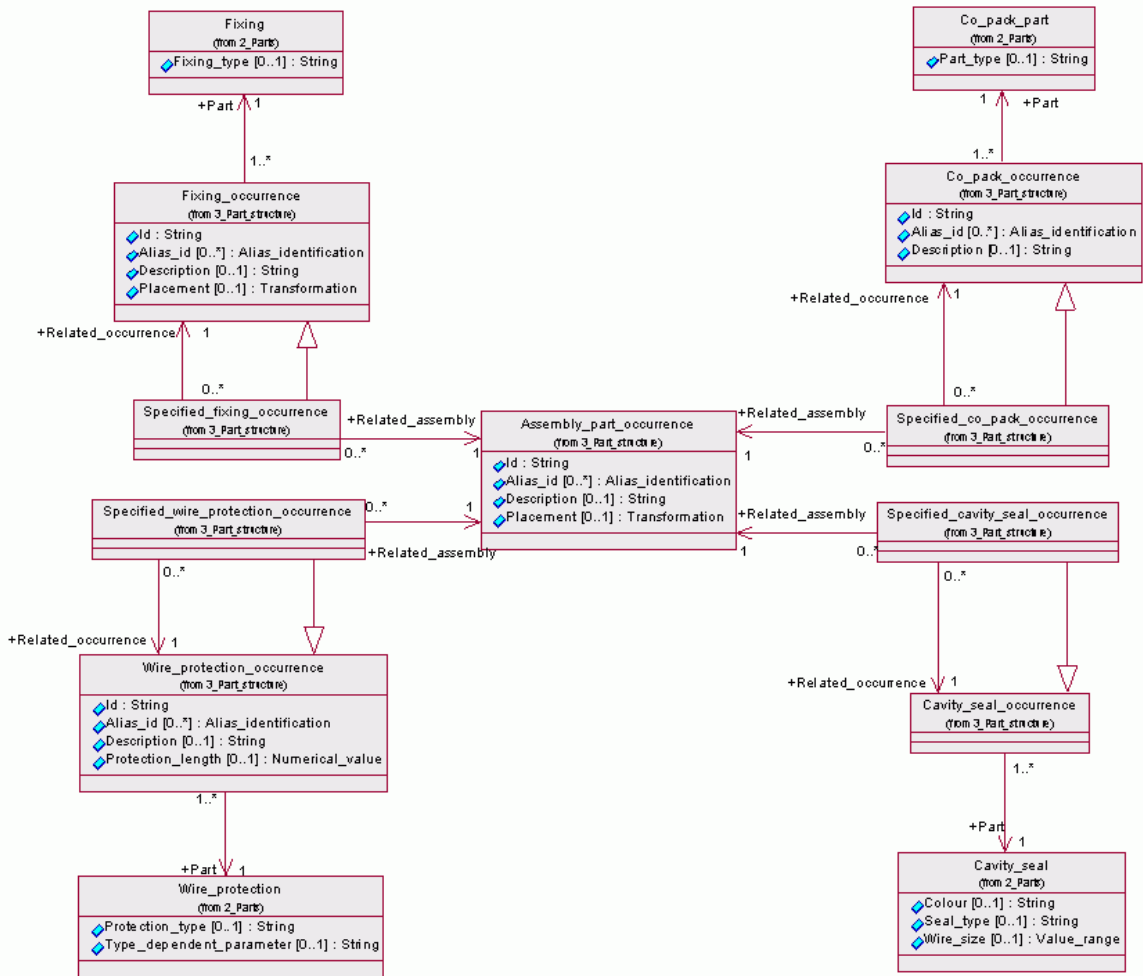


Diagram: (09) Part usage list (4)

Diagram: (10) Part usage list (5)

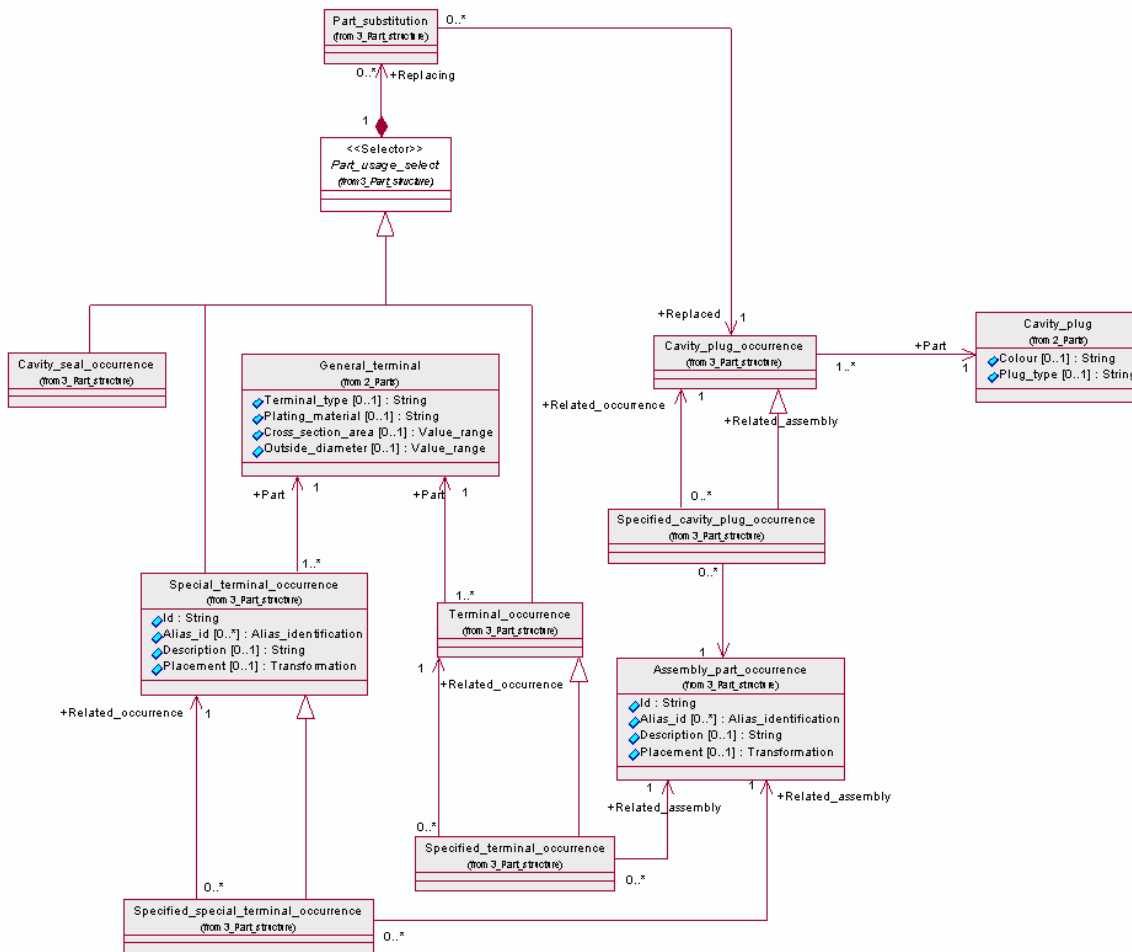


Diagram: (10) Part usage list (5)

Diagram: (11) Part usage list (6)

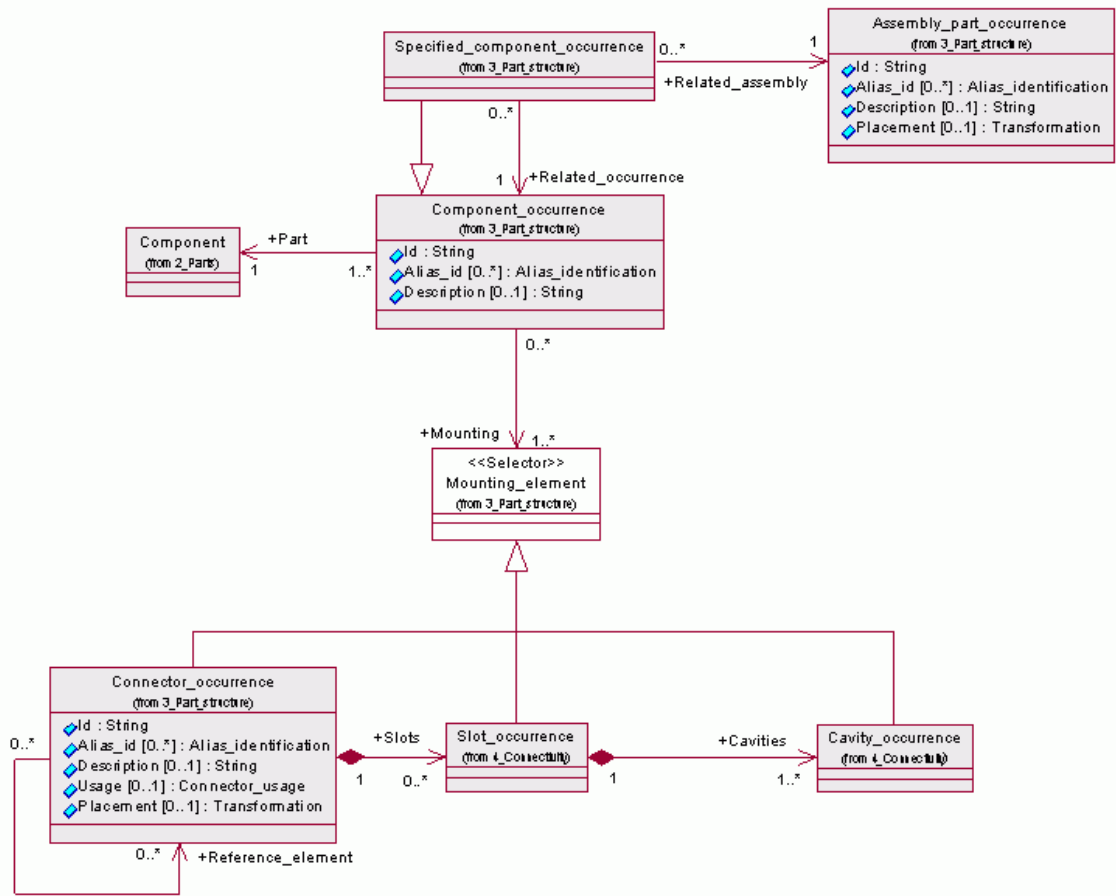


Diagram: (11) Part usage list (6)

Diagram: (12) Topology and routing (1)

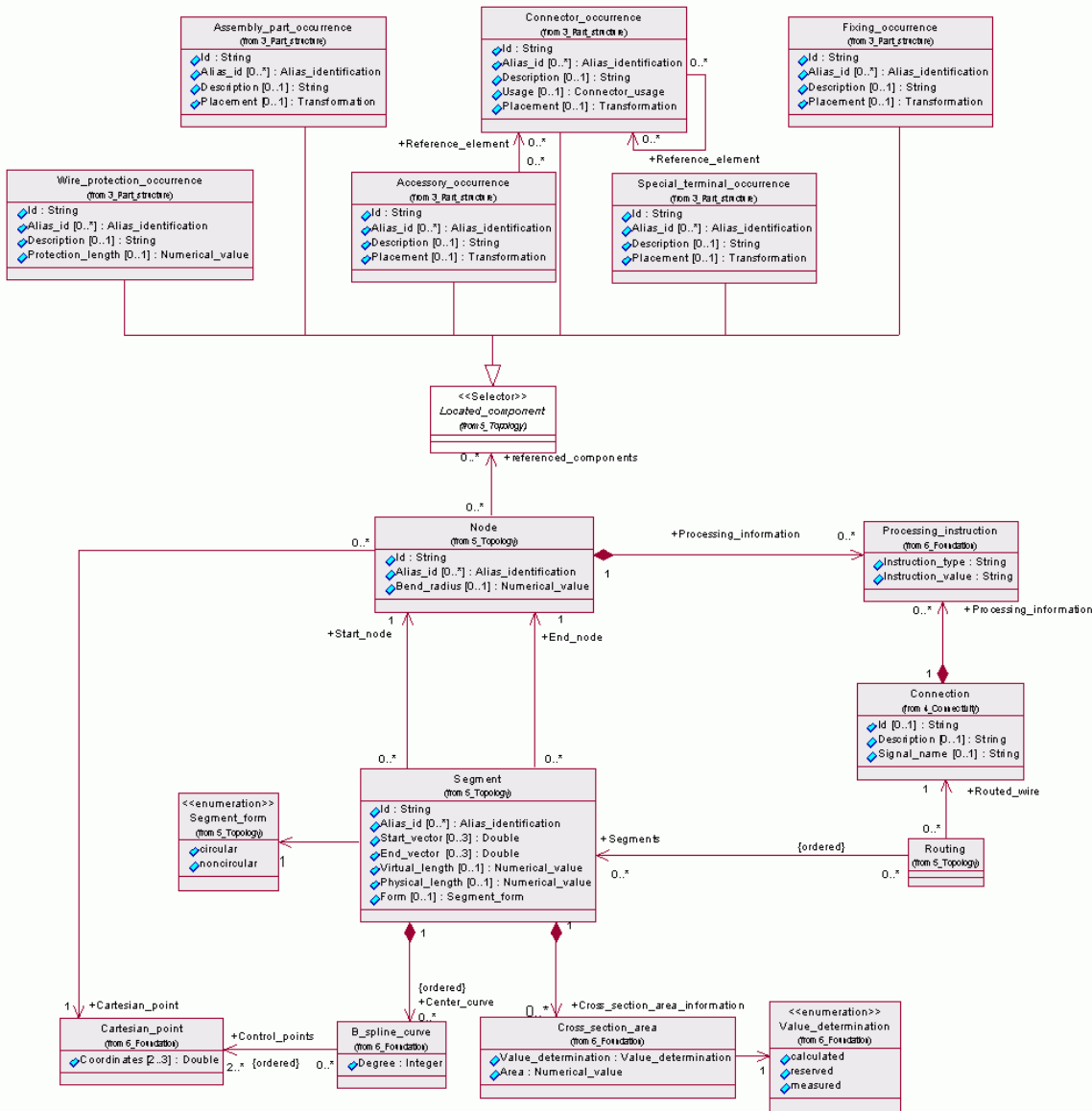


Diagram: (12) Topology and routing (1)

Diagram: (13) Topology and routing (2)

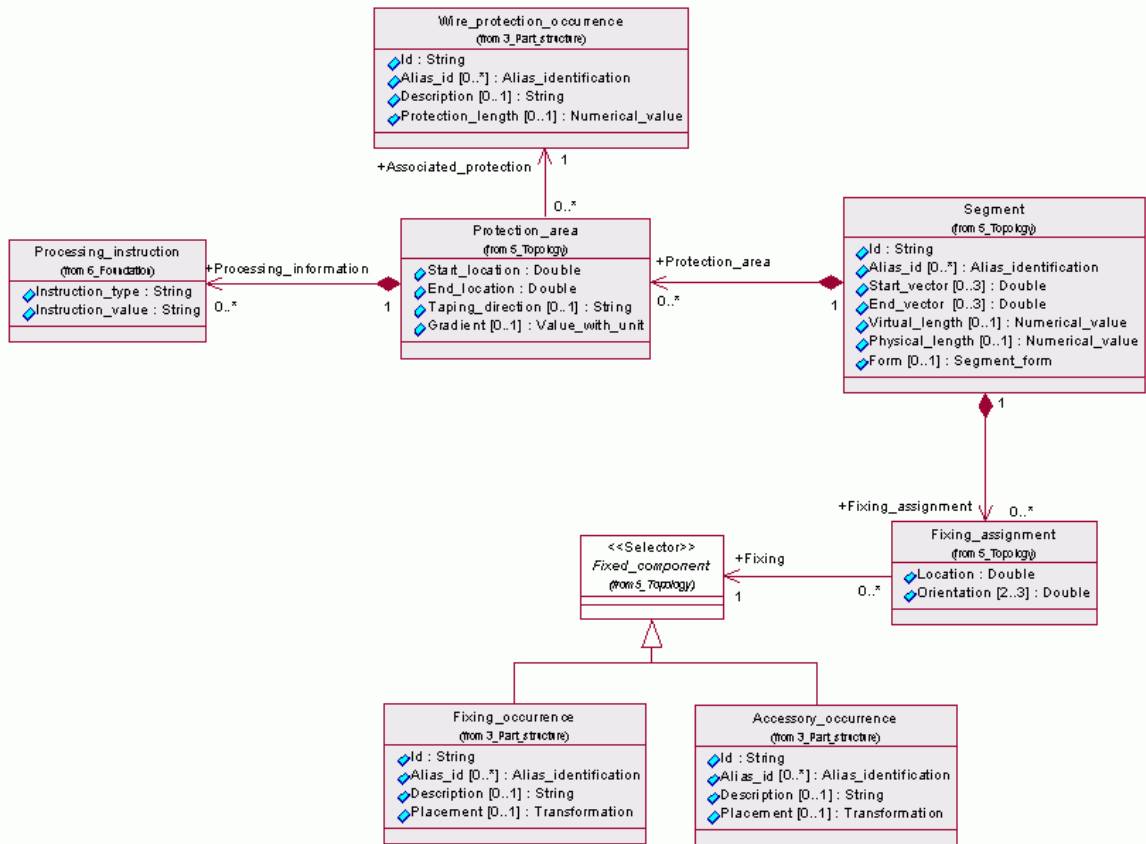


Diagram: (13) Topology and routing (2)

Diagram: (14) Dimensions

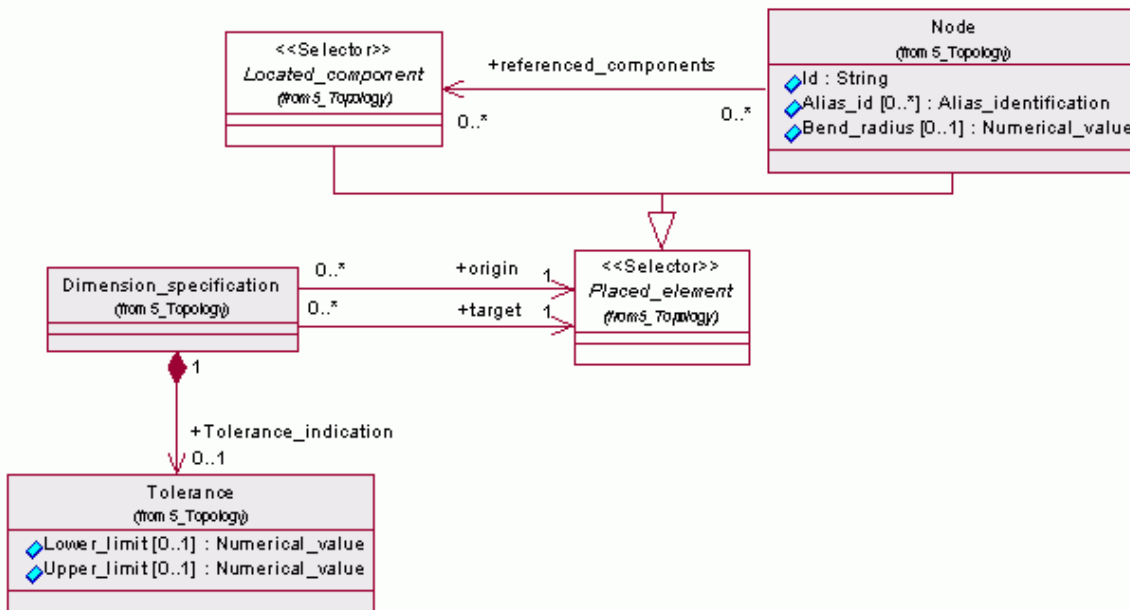


Diagram: (14) Dimensions

Diagram: (15) Miscellaneous

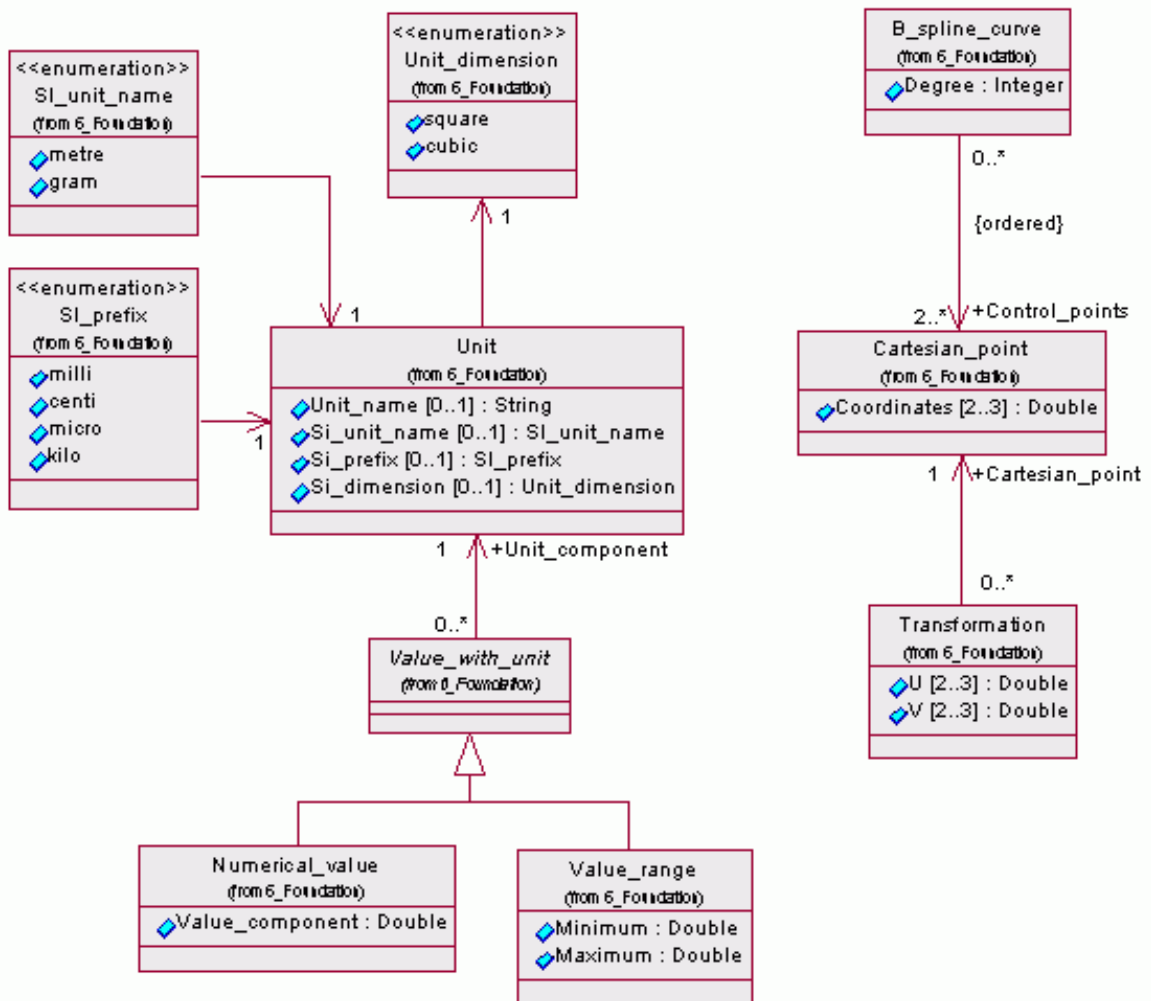


Diagram: (15) Miscellaneous

## Diagram: (16) KBL\_Container

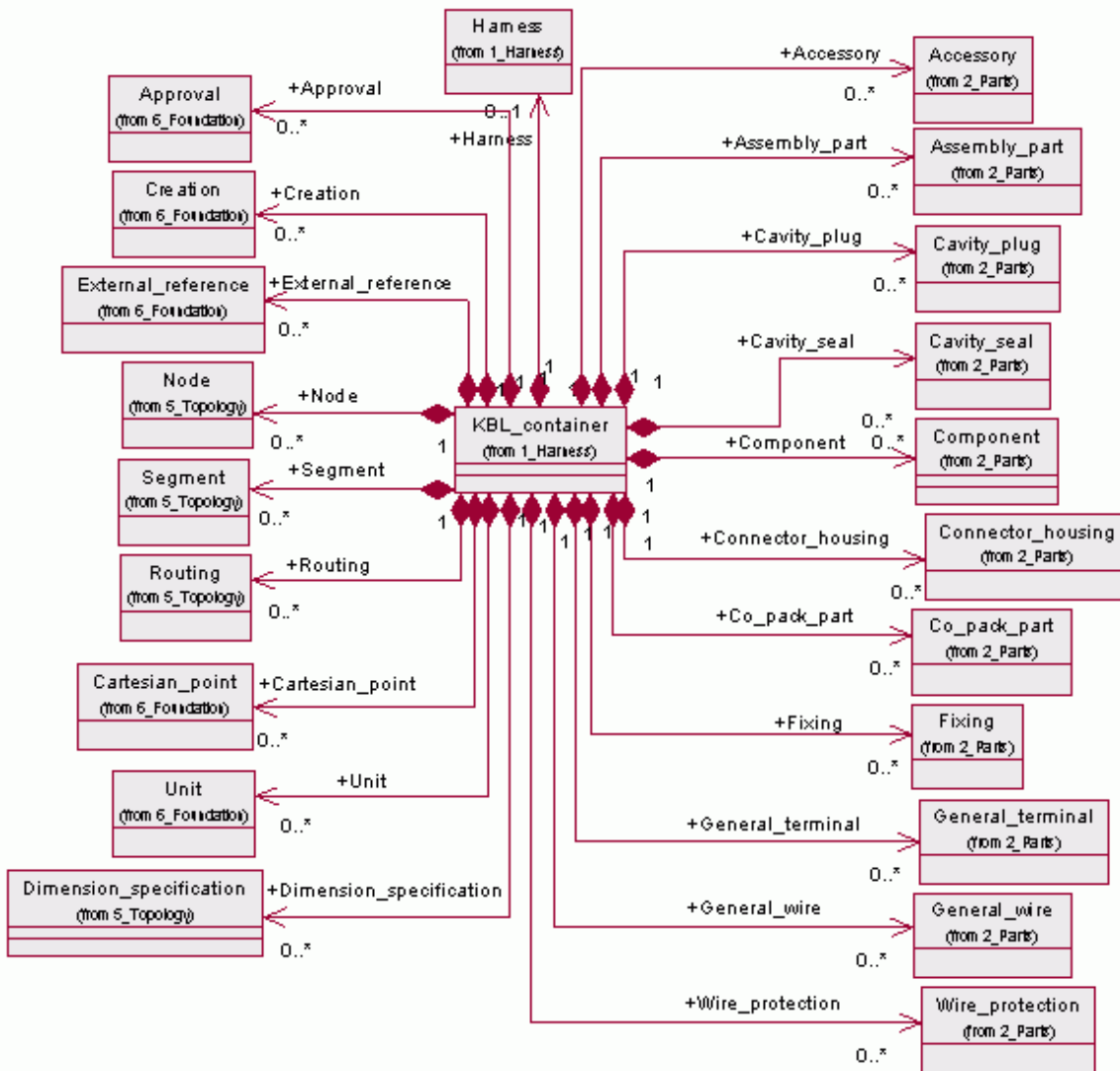


Diagram: (16) KBL\_Container

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