



# Vehicle Electric Container (VEC)

prostep ivip / VDA Recommendation  
Vehicle Electric Container (VEC)  
Version 1.2

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# 1 General

## 1.1 Preamble

The complexity of today's vehicle electrical systems is constantly growing. A vast variety of options is on the market. Firmly organized and integrated cross-company development processes are essential, combined with powerful, integrated IT infrastructures to support all cross stakeholders.

Against this background, the prostep ivip project group "Vehicle Electrical Systems Workflow Forum" and its predecessors have developed standardised data formats for the uniform description of wiring harnesses and related data. Providing the Harness Description List (KBL, PSI 19/VDA 4964) and supplementing schemas was a leap forward regarding the improvement of car electric development processes and their integration in the development processes for complete vehicles.

However, supporting the whole electric development processes and providing an integrated view on the complete electrical network of a vehicle was not in the scope of the provided specifications. Additional use cases must be addressed. The objective of the prostep ivip project group "Vehicle Electrical Systems Workflow Forum" is to collect these use cases and specify the Vehicle Electric Container (VEC) based on them as the required standardised data format in this context.

The VEC data format specification harmonizes and integrates the already existing solutions with the newly gathered requirements. The VEC data format specification addresses a significantly extended amount of use cases, focussing not only on one single wiring harness but on an electric system as a whole. The VEC data format specification supports a great variety of data exchange use cases all along the electric system development process.

The definition of the VEC was done with a focus on the requirements of the automotive industry. However, it is not restricted to this domain and it is expected that the VEC specification is applicable in aerospace industry and others as well.

## 1.2 Objectives of the recommendation

This Recommendation contains the specification of the VEC data format with the objective to

- Define a commonly agreed vocabulary and object semantics for the domain of the electrical design process in vehicles
- Facilitate data exchange between development and business partners in the context of physical electric system development and production planning
- Enable tool integration as well as tool-spanning traceability and tool-spanning change management
- Reduce complexity and at the same time increase flexibility by better decoupling tools and data
- Support paperless processes
- Provide a perspective for a solution for requirement in the context of long-term preservation

Concrete use cases are described in chapter 2.

Note: The VEC data format definition is explicitly not intended to be interpreted as a recommendation for the definition of the internal database structure of software tools.

### 1.3 Changes to preceding versions

Between this Version (1.2) and the direct predecessor (Version 1.1) over 190 individual issues have been addressed. The following section lists the main subjects that have been changed, improved or added. A complete and detailed change history is available in the ECAD Wiki and in the issue tracking system.

Changes that affect the resulting schema in an incompatible way are marked with a “X” in the last column. For more details on compatibility see Chapter 1.4.

Change	Inc.
Reorganization of the Model Outline (Chapter 5)	
Added “General Guidelines” for requirements on VEC implementations that are not strictly related to the model structure (Chapter 4).	
Added model documentation to the generated XML Schema files.	
General orthogonal grouping concept to represent functional mappings and requirements (see AssignmentGroup)	
Added concept for the instantiation of topologies.	
Added concept for hierarchical topologies supporting multiple use case (e.g. better traceability between geometry and harness process, splice position optimization, layered segments with a defined inner structure, composite segments, ...)	
Added concept for assigning topologies to zones.	
Completely revised the interpretation of Net- & ConnectionSpecification (Architectural Layer & System Schematic)	X
Refactoring of the multi-core representation	X
Added support for FIT-Rates for components	
Added concept to express conformance with requirements (see RequirementsConformanceSpecification)	
Added concept to define application constraints on instances (e.g. component nodes) (see ApplicationConstraint)	
Added concept for common variant configurations (base inclusion)	
Added concept to define system schematic traceability for directly mated E/E components.	
Added concept to define multicores in their usage (similar to twisted pairs)	
Added concept for traceability between wires and their respective fusing.	

Added concept to define bending restrictions on topologies.	
Added concept to define baselines (well defined sets of ItemVersions)	
Added concept to integrate with the 3D geometries of individual components (e.g. bounding box,	
Added concept for default tolerance definitions	
Added concept for wire addons in connectors.	
Allowed part usage (component instances without part number) in the bill of material.	
Added support for component selection tables.	
Added concepts to support 150% E/E component definitions.	
<p>Added concepts for the description of fuse boxes and other E/E-Components</p> <ul style="list-style-type: none"> <li>• internal connectivity</li> <li>• variance of internal connectivity</li> <li>• modularity</li> </ul>	
Improved modification tracking / change detection for the digital representation of documents (independent from the approval process in the domain)	
Refactored 3D representation of segments. Dropped current 3D-curve model and replaced it by complete representation of NURBS.	X
Added concept for integrated terminals and supplementary components in different contacting situations (e.g. wire fixations)	
Clarification that contact points are free of variance.	
Refactored attributes for compatibility definitions between terminals, plugs, cavities, seals and wires.	X
Added concept for flat band wires and flat cores.	
Dropped support for conformance classes.	X
Added support for grouping component ports by connector.	X
Definition of complex part relations	
Support for complex custom properties und multiple primitive types.	
Added support for hierarchical structures on variant groups and added multiple attributes to the classes in the variant configuration scope.	
Added support for grommets sealed with additional single wire seals.	
Refactored concept for supplementary parts of components in specified locations (e.g. Slots)	X

Added support for diodes	
Added support for cable ties	
Added support for multi-fuses	

The following list contains all minor changes, that affected schema compatibility.

Refactored and renamed "ContactSystem" to TerminalPairing	X
Path mistakenly inherited from ConfigurableElement	X
Moved "referenceElement" Association from PartOccurrence to OccurrenceOrUsage	X
Refactoring of WireProtectionRole, introduction of TapeRole	X
Redefined semantics for ConnectionGroup and NetGroup	X
Removed SealingClass and AbrasionResistanceClass (replaced by general concept RobustnessProperties).	X
Removed CompatibilityStatement & CompatibilitySpecification	X
Refactored modular slot definition (now using indirect references with PartVersion)	X
Refactored CopyrightInformation	X
Moved attribute TerminalSpecification.angle to WireReception	X
Removed Signal from Net-Layer	X
Refactoring of SheetOrChapter	X
Deprecation of CavityDesign in TerminalReceptionSpecification and CavitySpecification	X

#### 1.4 Compatibility to preceding versions

Version 1.2 is an extension of version 1.1. Model changes and extensions are guided by the fundamental principle of keeping already implemented concepts downward compatible as far as possible. However, this was not possible in all cases.

Compatibility is defined in the context of this document as the possibility that XML documents created for version 1.1 are still (schema) valid version 1.2 documents. In that sense, incompatible changes will result in schema validation errors if the version 1.1 file uses the affected model elements. Such changes are listed in Chapter 1.3 explicitly.

Additionally, version 1.2 introduces a large amount of open enumerations. As this reduces the degree of freedom in the model it is very likely that version 1.1 VEC files will not validate against the 1.2 strict schema.

Other changes that might be interpreted as incompatible, even without producing schema validation errors, are all improved or clarified documentations, as it might occur that earlier interpretations are now explicitly invalid model interpretations.

All VEC implementations that currently use custom properties for elements that have now (introduced with this version) explicit concepts should be changed accordingly.

## 1.5 Document structure

Chapter 2 describes some exemplary use cases for the application of the VEC data format.

Chapter 3 breaks down the requirements that the VEC data format specification has to meet.

Chapter 4 explains general concepts and guidelines that apply in a more cross-sectional way and cannot be linked to a specific individual model element.

Chapter 5 explains the meta model of the VEC data format and explains the concrete XML-based syntax of the VEC data format.

Appendix A contains a glossary for the most common abbreviations.

Appendix B contains the detailed meta model specification with a definition of all classes, attributes and relationships in alphabetical arrangement.

## 1.6 Abbreviations, terms and definitions

See Appendix A for a list of relevant abbreviations, terms and definitions.

## 1.7 Reference

Further information about this recommendation and related documents and specifications (e.g. the VEC.xsd) are available from

- The VDA and its working party PLM (see <http://www.vda.de>)
- The prostep ivip Association respectively the project groups VES Workflow Forum and ECAD-implementer forum (see <https://www.prostep.org/en/medialibrary/publications>, <https://ecad-wiki.prostep.org/>)

In addition to that, special reference goes to the recommendation PSI 19 / VDA 4964 Harness Description List (KBL) as previous recommendation.