IDTA 02035-3: Digital Battery Passport – Part 3 Product Carbon Footprint

February 2026

Submodel Template of the
Asset Administration Shell

Submodel Template
IDTA approved

- 100% AAS compliant
- Consistent & interoperable
- Released by the AAS experts

IDTA 02035-1 V1.0

Imprint

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Table of Contents

Chapter 1. General

1.1. About this document

This document is a part of an overall specification series [4]. Each part specifies the contents of a Submodel Template (SMT). The specifications of the Asset Administration Shell (AAS) are the basis for the Submodel Template specifications, see [3].

The target audience of the specification are developers and editors of technical documentation and manufacturer information, which are describing assets by means of the Asset Administration Shell (AAS) and therefore need to create a Submodel instance with a hierarchy of SubmodelElements. This document especially details on the question, which SubmodelElements with which semantic identification shall be used for this purpose.

This SMT will only be fully supported as of metamodel V3.1. V3.1 allows to assign idShorts to Elements within a SubmodelElementList (SML).

This specification was created following the "semantic-driven workflow" as defined in [5] based on Aspect Models [6]. There is no central dictionary or repository for Aspect Models. In this specification the following sources are used for defining semantics:

- Aspect Models published at IDTA [7]: https://github.com/admin-shell-io/smt-semantic-models

- Aspect Models published by the BatteryPass Consortium (closed project) [8]: https://github.com/batterypass/BatteryPassDataModel

- Aspect Models pubslihed at Tractus-X and used in standards published by Catena-X [9]: https://github.com/eclipse-tractusx/sldt-semantic-modelsl

1.2. Scope of the Submodel

This Submodel template aims to define the dynamic data points of a Battery Passport conformant to DIN DKE SPEC 99100 and the corresponding EU regulations.

The battery passport consists of the following 7 parts:

```
Digital Battery Passport - Part 1: Digital Nameplate (IDTA-02035-1)
Digital Battery Passport - Part 2: Handover Documentation (IDTA-02035-2)
Digital Battery Passport - Part 3: Product Carbon Footprint (IDTA-02035-3)
Digital Battery Passport - Part 4: Technical Data (IDTA-02035-4)
Digital Battery Passport - Part 5: Product Condition (IDTA-02035-5)
Digital Battery Passport - Part 6: Material Composition (IDTA-02035-6)
Digital Battery Passport - Part 7: Circularity (IDTA-02035-7)
```

This specification is Part 3: Product Carbon Footprint 1.0 (IDTA-02035-3).

1.3. Relevant standards for the Submodel template

This submodel template fulfills the requirements for dynamic data attributes as defined in DIN DKE SPEC 99100 [14]. DIN DKE 99100 "is based on the European Union and key Member States current regulatory requirements for battery passport information. Mandatory information for the battery passport as stated in the EU Battery Regulation (EU)2023/1542, Article77 and AnnexXIII, as well as the Ecodesign for Sustainable

Products Regulation (ESPR), is supplemented by recommendations to increase sustainability and circularity. [14]"

This document is valid for all battery categories. Please be aware that for battery categories that have stronger requirements like industrial batteries with battery management systems etc. some of the data points are specified as optional although mandatory per regulation.

1.4. Explanations on used UML diagrams

For clarity and an improved legibility readers suggested to go through this section at first before reading the following chapters.

UML diagrams feature box-like elements, called "classes". These classes, typically Submodels, SubmodelElementCollections or SubmodelElementLists, typically feature a set of Properties or further SubmodelElements. These elements can have specific cardinalities.

The single classes are hierarchally organized by aggregation relations, these can be seen as "contains" relation.

For a further overview on UML diagrams please refer to [6] and [10].

Further details about used table formats please refer to Annex A.

Chapter 2. Information set for Submodel "CarbonFootprint"

2.1. General

The "Product Carbon Footprint 1.0" Submodel Template is part of the specification series for the Battery Passport.

The Submodel template is a subset of the Submodel template "Carbon Footprint 1.0 (IDTA-02023)" with specific extensions for the Digital Battery Passport.

The submodel instance `Product Carbon Footprint` is used to declared in terms of kg of carbon dioxide equivalent per one kWh of the total energy provided by the battery over its expected service life. This submodel is relevant to the corresponding attributes of the DIN DKE SPEC 99100:

- Battery carbon footprint per Functional Unit
- Contribution of raw material acquisition and pre-processing lifecycle stage
- Contribution of main product production/manufacturing lifecycle stage
- Contribution of distribution lifecycle stage
- Contribution of end of life and recycling lifecycle stage
- Carbon footprint performance class
- Web link to public carbon footprint study
- General battery and manufacturer information
- Absolute battery carbon footprint

[UML_Submodel] shows the UML-diagram defining the relevant properties which need to be set.
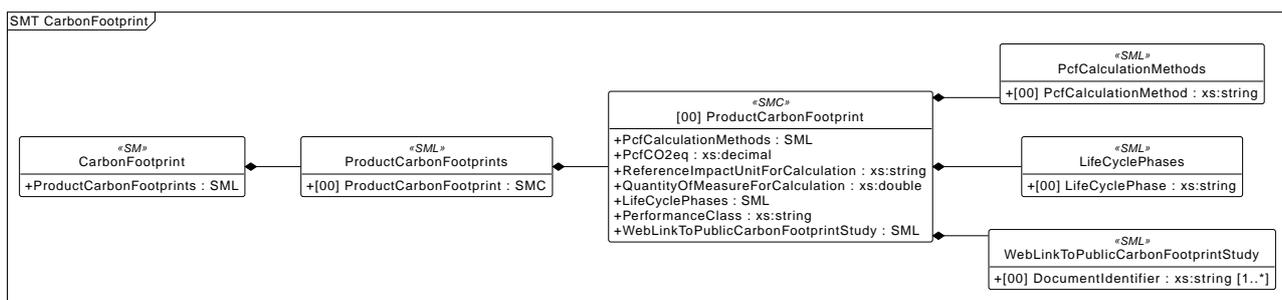
Figure 1. UML-Diagram for Submodel "Product Carbon Footprint" for batteries

The following attributes need to be set for the Submodel instance. The table convention is explained in Annex A.2.

The ECLASS IRDIs referenced in this Submodel are based on ECLASS Release 15. This version of the Submodel with these ECLASS IRDIs is also available in the download area of the ECLASS website: www.eclass.eu in form of the Asset.xml. The Asset.xml (Release 15) is the ECLASS file that contains Submodels. The use of these Submodels is free of charge.

2.2. Properties of the Submodel "CarbonFootprint"

idShort:	CarbonFootprint

Class:	Submodel		
semanticId:	https://admin-shell.io/idta/CarbonFootprint/CarbonFootprint/1/0		
Parent:	-		
Explanation:	The Submodel provides the means to access the Carbon Footprint of the asset.		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SML] ProductCarbonFootprints	https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprints/1/0 supplementalSemanticId: urn:samm:io.admin-shell.idta.batterypass.carbon_footprint:1.0.0#CarbonFootprintBattery Balance of greenhouse gas emissions along the entire life cycle of a product in a defined application and in relation to a defined unit of use.	[] 1 elements	1

2.3. Attributes of the SubmodelElemenList ProductCarbonFootprints

Table 1. Attributes of the SubmodelElementList instance

idShort:	**ProductCarbonFootprints**		
Class:	SubmodelElementList		
semanticId:	https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprints/1/0		
Parent:	CarbonFootprint		
Explanation:	Balance of greenhouse gas emissions along the entire life cycle of a product in a defined application and in relation to a defined unit of use.		
Element details:	orderRelevant=No, semanticIdListElement=[GlobalReference, https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprint/1/0], typeValueListElement=SubmodelElementCollection		
[SME type] idShort	semanticId Description@en	[valueType] example	card.

| [SMC]

ProductCarbon
Footprint | https://admin-
shell.io/idta/CarbonFootprint/ProductCarbonFootprint/1/0

supplementalSemanticId: urn:samm:io.admin-
shell.idta.batterypass.carbon_footprint:1.0.0#ProductCarb
onFootprint

Balance of greenhouse gas emissions along the entire life
cycle of a product in a defined application and in relation
to a defined unit of use. | []

7 elements | |

2.4. Attributes of the SubmodelElementCollection ProductCarbonFootprint

Table 2. Attributes of the SubmodelElementCollection instance

idShort:	**ProductCarbonFootprint**		
Class:	SubmodelElementCollection		
semanticId:	https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprint/1/0		
Parent:	ProductCarbonFootprints		
Explanation:	Balance of greenhouse gas emissions along the entire life cycle of a product in a defined application and in relation to a defined unit of use.		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SML] PcfCalculation Methods	https://admin- shell.io/idta/CarbonFootprint/PcfCalculationMethods/1/0 supplementalSemanticId: urn:samm:io.admin- shell.idta.carbon_footprint:1.0.0#pcfCalculationMethods Standards, methods for determining the greenhouse gas emissions of a product. This Value List is based on ECLASS 15 with IRDI 0173- 1#09-AAO115#003. The full list can be found in Section 2.5 in "Product Carbon Footprint 1.0 (IDTA-02023)".	[] 1 elements	1
[Prop] PcfCO2eq	0173-1#02-ABG855#003 supplementalSemanticId: urn:samm:io.admin- shell.idta.carbon_footprint:1.0.0#pcfCo2eq sum of all greenhouse gas emissions of a product according to the quantification requirements of the standard DIN DKE Spec 99100 chapter reference: 6.3.2	[Decimal]	1

[Prop] ReferenceImpactUnitForCalculation	0173-1#02-ABG856#003 supplementalSemanticId: urn:samm:io.admin-shell.idta.carbon_footprint:1.0.0#referenceImpactUnitForCalculation Quantity unit of the product to which the PCF information on the CO2 footprint refers If a normalized product carbon footprint (PCF) value is provided, the reference value for calculation should be a specific unit such as 'kWh'. If the total PCF value is provided the reference value for calculation should be 'piece'.	[String]	1
[Prop] QuantityOfMeasureForCalculation	0173-1#02-ABG857#003 supplementalSemanticId: urn:samm:io.admin-shell.idta.carbon_footprint:1.0.0#quantityOfMeasureForCalculation provides the quantity number of pieces or mass or volume to compute the impact of climate change or product carbon footprint If a normalized product carbon footprint (PCF) value is provided, the quantity of measure for calculation should be 1. If the total PCF value is provided the quantity of measure for calculation should be 1.	[Double]	1
[SML] LifeCyclePhases	https://admin-shell.io/idta/CarbonFootprint/LifeCyclePhases/1/0 supplementalSemanticId: urn:samm:io.admin-shell.idta.carbon_footprint:1.0.0#lifeCyclePhases, 0173-1#02-ABG858#003 List of life cycle stages of the product according to the quantification requirements of the standard to which the PCF carbon footprint statement refers. The string value in the value list is based on DIN DKE SPEC 99100: "A1 - raw material supply (and upstream production)" (6.3.5 required lify cycle mapping), "A3 - production" (6.3.4 Contribution of main product production/manufacturing lifecycle stage), "A4 - transport to final destination" (6.3.5 Contribution of distribution lifecycle stage), "C3 - recycling, waste treatment" (6.3.6 Contribution of end of life and recycling lifecycle stage) Please note that the model should always contain at least one Product Carbon Footprint entry that reflects the total PCF value (including all life cycle phases) of the battery.	[] 1 elements	1

[Prop] PerformanceClass	urn:samm:io.admin-shell.idta.batterypass.carbon_footprint:1.0.0#performanceClass The battery passport must include the carbon footprint performance class in accordance with the entry into force of the delegated and implementing acts on the carbon footprint performance classes per Article7 of the Battery Regulation. DIN DKE Spec 99100 chapter reference: 6.3.7	[String]	1
[SML] WebLinkToPublicCarbonFootprintStudy	urn:samm:io.admin-shell.idta.batterypass.carbon_footprint:1.0.0#webLinkToPublicCarbonFootprintStudy One or more document identifiers (depending, for example, on the translation) of a specific document, which can be found in the 'HandoverDocumentation' model. DIN DKE Spec 99100 chapter reference: 6.3.8	[] 1 elements	1

2.5. Attributes of the SubmodelElemenList PcfCalculationMethods

Table 3. Attributes of the SubmodelElementList instance

idShort:	PcfCalculationMethods		
Class:	SubmodelElementList		
semanticId:	https://admin-shell.io/idta/CarbonFootprint/PcfCalculationMethods/1/0		
Parent:	ProductCarbonFootprint		
Explanation:	Standards, methods for determining the greenhouse gas emissions of a product. This Value List is based on ECLASS 15 with IRDI 0173-1#09-AAO115#003. The full list can be found in Section 2.5 in "Product Carbon Footprint 1.0 (IDTA-02023)".		
Element details:	orderRelevant=No, semanticIdListElement=[GlobalReference, 0173-1#02-ABG854#003], typeValueListElement=Property, valueTypeListElement=xs:string		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] PcfCalculation Method	0173-1#02-ABG854#003 standard, method for determining the greenhouse gas emissions of a product	[String]	1

2.6. Attributes of the SubmodelElemenList LifeCyclePhase

Table 4. Attributes of the SubmodelElementList instance

idShort:	LifeCyclePhases		
Class:	SubmodelElementList		
semanticId:	https://admin-shell.io/idta/CarbonFootprint/LifeCyclePhases/1/0		
Parent:	ProductCarbonFootprint		
Explanation:	List of life cycle stages of the product according to the quantification requirements of the standard to which the PCF carbon footprint statement refers. The string value in the value list is based on DIN DKE SPEC 99100: "A1 - raw material supply (and upstream production)" (6.3.5 required lify cycle mapping), "A3 - production" (6.3.4 Contribution of main product production/manufacturing lifecycle stage), "A4 - transport to final destination" (6.3.5 Contribution of distribution lifecycle stage), "C3 - recycling, waste treatment" (6.3.6 Contribution of end of life and recycling lifecycle stage) Please note that the model should always contain at least one Product Carbon Footprint entry that reflects the total PCF value (including all life cycle phases) of the battery.		
Element details:	orderRelevant=No, semanticIdListElement=[GlobalReference, 0173-1#02-ABG858#003], typeValueListElement=Property, valueTypeListElement=xs:string		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] LifeCyclePhase	0173-1#02-ABG858#004	[String]	1

2.7. Attributes of the SubmodelElementList WebLinkToPublicCarbonFootprintStudy

Table 5. Attributes of the SubmodelElementList instance

idShort:	WebLinkToPublicCarbonFootprintStudy		
Class:	SubmodelElementList		
semanticId:	urn:samm:io.admin-shell.idta.batterypass.carbon_footprint:1.0.0#webLinkToPublicCarbonFootprintStudy		
Parent:	ProductCarbonFootprint		
Explanation:			
Element details:	orderRelevant=No, typeValueListElement=SubmodelElement		
[SME type] idShort	semanticId Description@en	[valueType] example	card.

[Prop] DocumentIdentifier	urn:samm:io.admin-shell.idta.handover_documentation:2.0.0#DocumentIdentifier supplementalSemanticId: 0173-1#02-AAO099#004 Document identifier of the document (e.g., PDF) that can be found in the HandoverDocumentation Submodel. DIN DKE Spec 99100 chapter reference: 6.3.8	[String] XF90-884	1..*
[Prop] DocumentIdentifier	urn:samm:io.admin-shell.idta.handover_documentation:2.0.0#DocumentIdentifier supplementalSemanticId: 0173-1#02-AAO099#004	[String] XF90-884	1..*

Annex A. Explanations on used table formats

1. General

The used tables in this document try to outline information as concise as possible. They do not convey all information on Submodels and SubmodelElements. For this purpose, the definitive definitions are given by a separate file in form of an AASX file of the Submodel template and its elements.

2. Tables on Submodels and SubmodelElements

For clarity and brevity, a set of rules is used for the tables for describing Submodels and SubmodelElements.

- The tables follow in principle the same conventions as in [5].

- The table heads abbreviate 'cardinality' with 'card'.

- The tables often place two informations in different rows of the same table cell. In this case, the first information is marked out by sharp brackets [] form the second information. A special case are the semanticIds, which are marked out by the format: (type)(local)[idType]value.

- The types of SubmodelElements are abbreviated (see Table 6):

Table 6. Abbreviations for SubmodelElements

SME type	SubmodelElement type
Blob	Blob
Cap	Capability
Ent	Entity
Evt	Event
File	File
MLP	MultiLanguageProperty
Opr	Operation
Prop	Property
Range	Range
Ref	ReferenceElement
Rel	RelationshipElement
RelA	AnnotatedRelationshipElement
SMC	SubmodelElementCollection
SME	SubmodelElement type
SML	SubmodelElementList

- If an idShort ends with '__00__', this indicates a suffix of the respective length (here: 2) of decimal digits, in order to make the idShort unique. A different idShort might be choosen, as long as it is unique in the parent's context.

- The Keys of semanticId in the main section feature only idType and value, such as: https://admin-shell.io/vdi/2770/1/0/DocumentId/Id. The attribute "type" (typically "ConceptDescription" and "(local)" or

"GlobalReference") need to be set accordingly; see [6].

- If a table does not contain a column with "parent" heading, all represented attributes share the same parent. This parent is denoted in the head of the table.

- Multi-language strings are represented by the text value, followed by '@'-character and the ISO 639 language code: example@EN.

- The [valueType] is only given for Properties.

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