IDTA-02035-5 : Digital Battery Passport - Part 7

Circularity

August 2025

SPECIFICATION

Submodel Template

IDTA approved

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

Submodel Template of the
Asset Administration Shell

IDTA-02035-7 V1.0

Imprint

1. Publisher

> Industrial Digital Twin Association
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> Germany
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Version history

Date	Version	Comment
August 2025	1.0	First version. Result of the joint Model Expert Group from IDTA, Catena-X and the BatteryPass Consortium.
18.08.2025	1.0	Start of the official review period with IDTA, Catena-X and the BatteryPass Consortium.

Table of Contents

Chapter 1. General

1.1. About this document

2. 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].

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.

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

5. 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, models with namespace "io.admin-shell"
   - Aspect Models published by the BatteryPass Consortium (closed project) [8]: https://github.com/batterypass/BatteryPassDataModel, models with namespace "io.BatteryPass"
   - Aspect Models published at Tractus-X and used in standards published by Catena-X [9]: https://github.com/eclipse-tractusx/sldt-semantic-models, models with namespace "io.catenax"

6. Known Issues:

   - cardinality information is not available on all levels

     NOTE | when reviewing the document assume cardinality "1" in case cardinality is not explicitly defined

   - so far semanticIds for SMC are not contained

1.2. Scope of the Submodel

7. 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.

8. 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)
```

9. This specification is Part 7: Circularity (IDTA_02035-7).

1.3. Relevant standards for the Submodel Template

10. This submodel template fulfills the requirements for dynamic data attributes as defined in DIN DKE SPEC 99100 [1]. 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. [1]"

11. 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

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

13. 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.

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

15. For a further overview on UML diagrams please refer to [2] and [3].

16. Further details about used table formats please refer to [Annex_A_Explanations].

Chapter 2. Information set for Submodel “ProductCondition”

2.1. General

17. The "Circularity" Submodel Template is part of the specification series for the Battery Passport.

18. **Property specification**

19. See clause 3 "Information structures and attributes".

2.2. Overview UML model

20. The SubmodelElements described in section 3 are structured in the following way (see Figure 1):

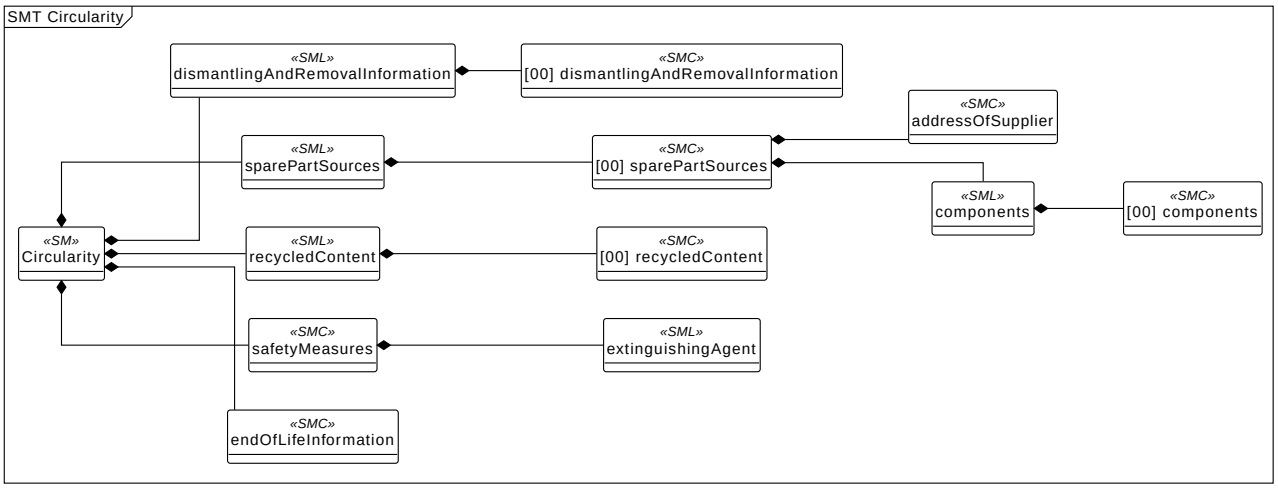

Figure 1. UML overview

Chapter 3. Information structures and attributes

3.1. Properties of the Submodel “Circularity”

21. Figure 2 shows the UML-diagram defining the relevant properties which need to be set.

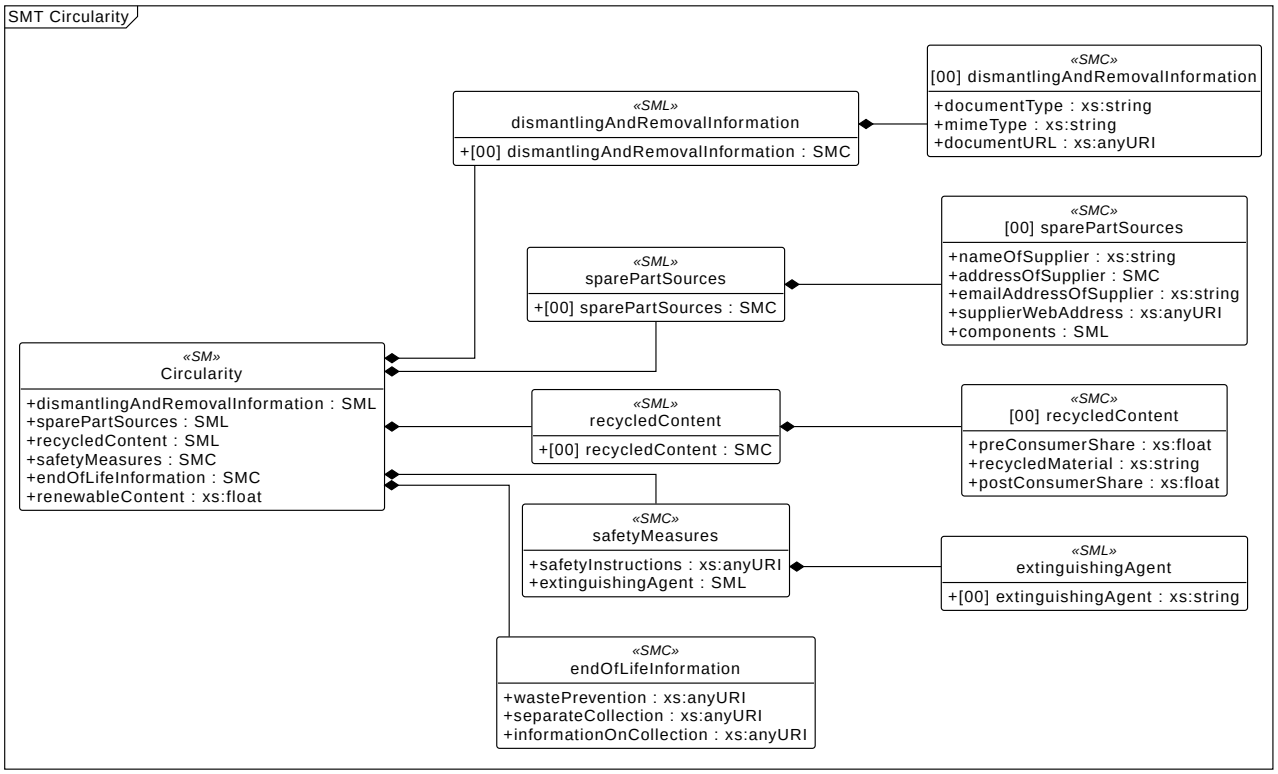

Figure 2. UML-Diagram for Submodel "Nameplate"

idShort:	**Circularity**
Class:	Submodel
semanticId:	urn:samm:io.admin-shell.idta.batterypass..Circularity:1.2.0#Circularity
Parent:	-
Explanation:	Dismantling information (including at least: exploded diagrams of the battery system/pack showing the location of battery cells; disassembly sequences; type and number of fastening techniques to be unlocked; tools required for disassembly; warnings if risk of damaging parts exists; amount of cells used and layout); part numbers for components and contact details of sources for replacement spares; safety measures (Annex XIII (2b-d)); usable extinguishing agent (Annex VI, Part A(9)). 2024 Circulor (for and on behalf of the Battery Pass Consortium). This work is licensed under a Creative Commons License Attribution-NonCommercial 4.0 International (CC BY-NC 4.0). Readers may reproduce material for their own publications, as long as it is not sold commercially and is given appropriate attribution.
Element details:	-

[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SML] dismantlingAndRemovalInformation	urn:samm:io.BatteryPass.Circularity:1.2.0#DocumentationList Dismantling and Removal information, including at least:- Exploded diagrams of the battery system/pack showing the location of battery cells- Disassembly sequences- Type and number of fastening techniques to be unlocked- Tools required for disassembly- Warnings if risk of damaging parts exists- Amount of cells used and layout. BR Annex XIII (2c) DIN DKE Spec 99100 chapter reference: 6.6.1.2	[] 1 elements	1
[SML] sparePartSources	urn:samm:io.BatteryPass.Circularity:1.2.0#SparePartSourcesList Contact details of sources for replacement spares. Postal address, including name and brand names, postal code and place, street and number, country, telephone, if any. BR Annex XIII (2b) DIN DKE Spec 99100 chapter reference: 6.6.1.3	[] 1 elements	1
[SML] recycledContent	urn:samm:io.BatteryPass.Circularity:1.2.0#RecycledContentList Share of material recovered from waste present in active materials for each battery model per year and per manufacturing plant. DIN DKE Spec 99100 chapter reference: 6.6.2.3 - 6.6.2.10	[] 1 elements	1
[SMC] safetyMeasures	+ Safety measures and instructions should also take past negative and extreme events as well as the separate data attributes ?battery status? and ?battery composition/chemistry? into account. DIN DKE Spec 99100 chapter reference: 6.6.1.5	[] 2 elements	1

[SMC] endOfLifeInformation	+ Producer or producer responsibility organisations shall make information available to distributors and end-users on: the role of end-users in contributing to waste prevention, including by information on good practices and recommendations concerning the use of batteries aiming at extending their use phase and the possibilities of re-use, preparing for re-use, preparing for repurpose, repurposing and remanufacturing. DIN DKE Spec 99100 chapter reference: 6.6.3.2 - 6.6.3.4	[] 3 elements	1
[Prop] renewableContent	urn:samm:io.BatteryPass.Circularity:1.2.0#renewableContent Share of renewable material content. A renewable material is a material made of natural resources that can be replenished. DIN DKE Spec 99100 chapter reference: 6.6.2.11	[Float]	1

3.2. Properties of the SML "dismantlingAndRemovalInformation"

22. Figure 3 shows the UML-diagram for `SML dismantlingAndRemovalInformation`.

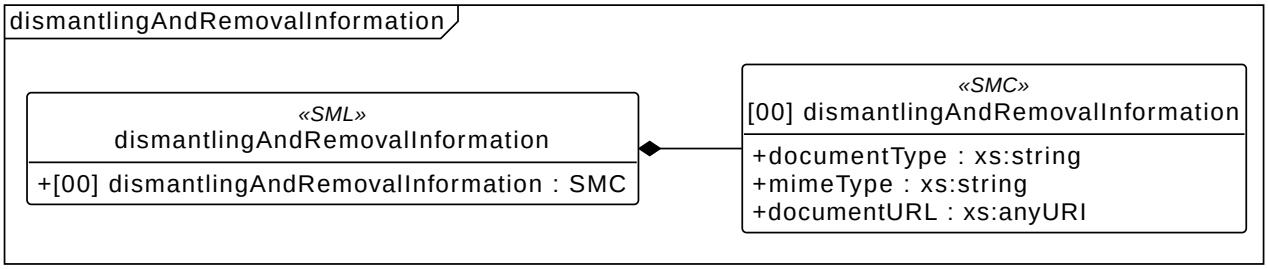

Figure 3. UML-Diagram for SML "negativeEvents"

23. List of data points related to dismantling and removal information.

idShort:	**dismantlingAndRemovalInformation**
Class:	SubmodelElementList
semanticId:	urn:samm:io.BatteryPass.Circularity:1.2.0#DocumentationList
Parent:	Circularity
Explanation:	Dismantling and Removal information, including at least:- Exploded diagrams of the battery system/pack showing the location of battery cells- Disassembly sequences- Type and number of fastening techniques to be unlocked- Tools required for disassembly- Warnings if risk of damaging parts exists- Amount of cells used and layout. BR Annex XIII (2c) DIN DKE Spec 99100 chapter reference: 6.6.1.2
Element details:	orderRelevant=No, typeValueListElement=SubmodelElementCollection

[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SMC] dismantlingAndRemovalInformation	+ Dismantling and Removal information, including at least:- Exploded diagrams of the battery system/pack showing the location of battery cells- Disassembly sequences- Type and number of fastening techniques to be unlocked- Tools required for disassembly- Warnings if risk of damaging parts exists- Amount of cells used and layout. BR Annex XIII (2c) DIN DKE Spec 99100 chapter reference: 6.6.1.2	[] 3 elements	

3.3. Properties of the SML "sparePartSources"

24. Figure 4 shows the UML-diagram for `SML sparePartSources`.

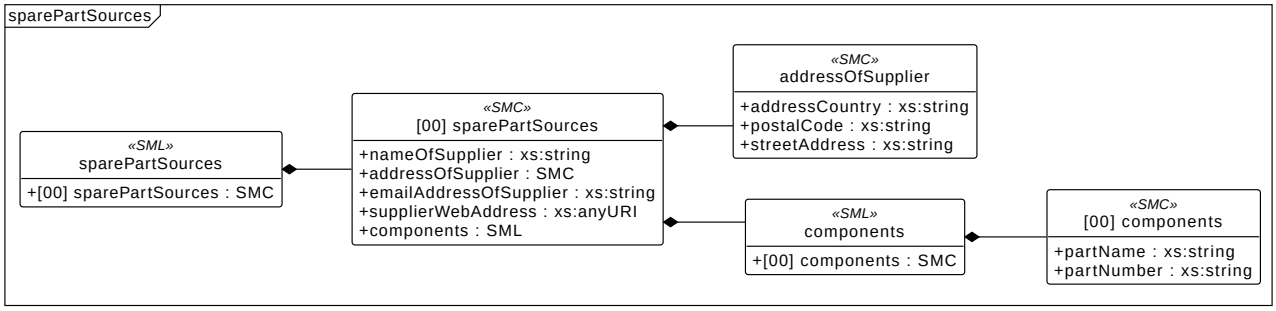

Figure 4. UML-Diagram for SML "sparePartSources"

25. List of data points related to spare part sources.

idShort:	**sparePartSources**		
Class:	SubmodelElementList		
semanticId:	urn:samm:io.BatteryPass.Circularity:1.2.0#SparePartSourcesList		
Parent:	Circularity		
Explanation:	Contact details of sources for replacement spares. Postal address, including name and brand names, postal code and place, street and number, country, telephone, if any. BR Annex XIII (2b) DIN DKE Spec 99100 chapter reference: 6.6.1.3		
Element details:	orderRelevant=No, typeValueListElement=SubmodelElementCollection		
[SME type] idShort	semanticId Description@en	[valueType] example	card.

[SMC] sparePartSources	+ Contact details of sources for replacement spares. Postal address, including name and brand names, postal code and place, street and number, country, telephone, if any. BR Annex XIII (2b) DIN DKE Spec 99100 chapter reference: 6.6.1.3	[] 5 elements	

3.4. Properties of the SML "recycledContent"

26. Figure 5 shows the UML-diagram for `SML recycledContent`.

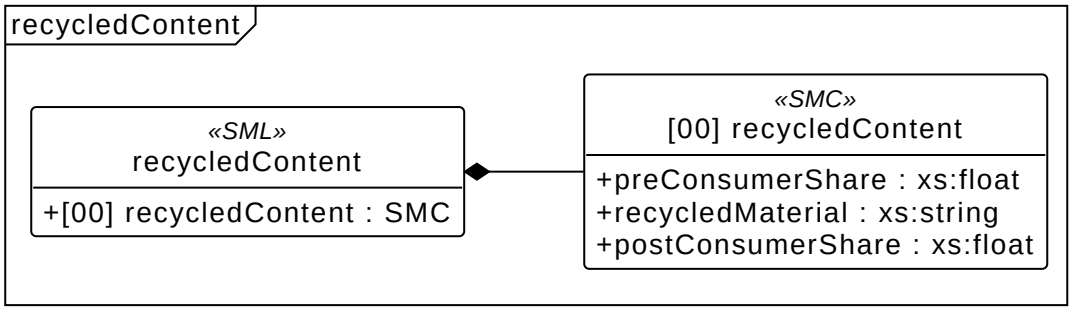

Figure 5. UML-Diagram for SML "recycledContents"

27. List of data points related to recycled content.

idShort:	**recycledContent**		
Class:	SubmodelElementList		
semanticId:	urn:samm:io.BatteryPass.Circularity:1.2.0#RecycledContentList		
Parent:	Circularity		
Explanation:	Share of material recovered from waste present in active materials for each battery model per year and per manufacturing plant. DIN DKE Spec 99100 chapter reference: 6.6.2.3 - 6.6.2.10		
Element details:	orderRelevant=No, typeValueListElement=SubmodelElementCollection		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SMC] recycledContent	+ Share of material recovered from waste present in active materials for each battery model per year and per manufacturing plant. DIN DKE Spec 99100 chapter reference: 6.6.2.3 - 6.6.2.10	[] 3 elements	

3.5. Properties of the SMC "safetyMeasures"

28. [UML_for_SMC_safetyMeasures] shows the UML-diagram for `SMC safetyMeasures`.

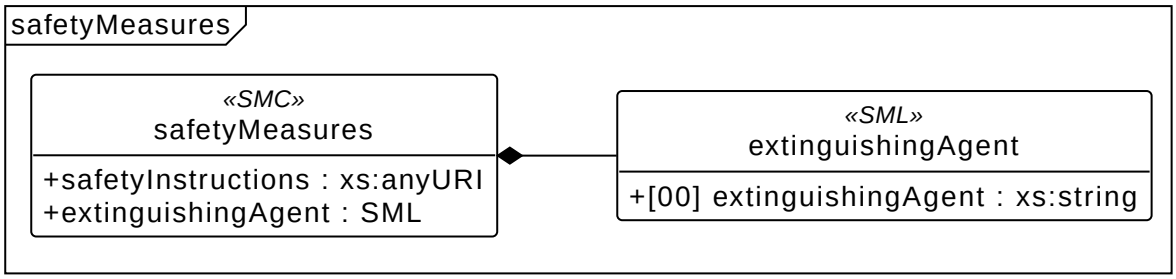

Figure 6. UML-Diagram for SMC "safetyMeasures"

29. Data points related to safety measures.

idShort:	**safetyMeasures**		
Class:	SubmodelElementCollection		
semanticId:			
Parent:	Circularity		
Explanation:	Safety measures and instructions should also take past negative and extreme events as well as the separate data attributes ?battery status? and ?battery composition/chemistry? into account. DIN DKE Spec 99100 chapter reference: 6.6.1.5		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] safetyInstructions	urn:samm:io.BatteryPass.Circularity:1.2.0#safetyInstructions - Safety measures. - Necessary safety instructions to handle waste batteries, including in relation to the risks associated with, and the handling of, batteries containing lithium.	[AnyUri]	1
[SML] extinguishingAgent	urn:samm:io.BatteryPass.Circularity:1.2.0#ExtinguishingAgentsList Usable extinguishing agents refering to classes of extinguishers (A, B, C, D, K).EUBR: Annex XIII (1a) ? Annex VI Part A (9)	[] 1 elements	1

3.6. Properties of the SMC "endOfLifeInformation"

30. [UML_for_SMC_endOfLifeInformation] shows the UML-diagram for `SMC endOfLifeInformation`.

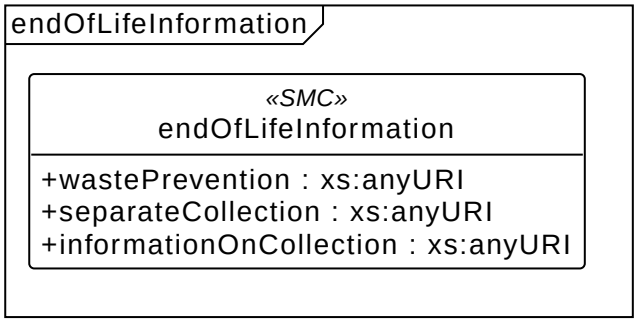

Figure 7. UML-Diagram for SML "endOfLifeInformation"

31. Data points related to end of life information.

idShort:	**endOfLifeInformation**		
Class:	SubmodelElementCollection		
semanticId:			
Parent:	Circularity		
Explanation:	Producer or producer responsibility organisations shall make information available to distributors and end-users on: the role of end-users in contributing to waste prevention, including by information on good practices and recommendations concerning the use of batteries aiming at extending their use phase and the possibilities of re-use, preparing for re-use, preparing for repurpose, repurposing and remanufacturing. DIN DKE Spec 99100 chapter reference: 6.6.3.2 - 6.6.3.4		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] wastePrevention	urn:samm:io.BatteryPass.Circularity:1.2.0#wastePrevention Prevention and management of waste batteries: Point (a) of Article 60(1): Information on the role of end-users in contributing to waste prevention, including by information on good practices and recommendations concerning the use of batteries aiming at extending their use phase and the possibilities of re-use, preparing for re-use, preparing for repurpose, repurposing and remanufacturing	[AnyUri]	1
[Prop] separateCollection	urn:samm:io.BatteryPass.Circularity:1.2.0#separateCollection Prevention and management of waste batteries: Point (b) of Article 60(1): Information on the role of end-users in contributing to the separate collection of waste batteries in accordance with their obligations under Article 51 so as to allow their treatment	[AnyUri]	1

[Prop] informationOnCollection	urn:samm:io.BatteryPass.Circularity:1.2.0#informationOnCollection Prevention and management of waste batteries: Point (c) of Article 60(1): information on the separate collection, the take back, the collection points and preparing for re-use, preparing for repurposing, and recycling operations available for waste batteries	[AnyUri]	1

3.7. Properties of the SMC "dismantlingAndRemovalInformation"

32. Figure 8 shows the UML-diagram for `SMC dismantlingAndRemovalInformation`.

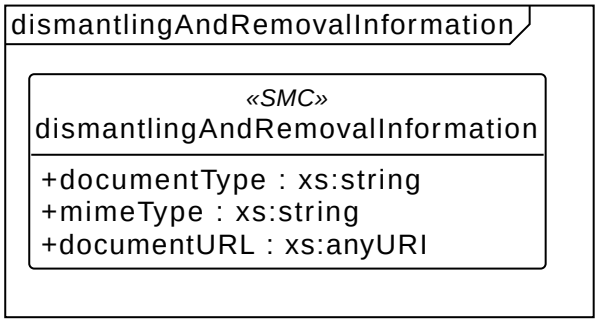

Figure 8. UML-Diagram for SML "negativeEvents"

33. Data points related to dismantling and removal information.

idShort:	**dismantlingAndRemovalInformation**		
Class:	SubmodelElementCollection		
semanticId:			
Parent:	dismantlingAndRemovalInformation		
Explanation:	Dismantling and Removal information, including at least:- Exploded diagrams of the battery system/pack showing the location of battery cells- Disassembly sequences- Type and number of fastening techniques to be unlocked- Tools required for disassembly- Warnings if risk of damaging parts exists- Amount of cells used and layout. BR Annex XIII (2c) DIN DKE Spec 99100 chapter reference: 6.6.1.2		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] documentType	urn:samm:io.BatteryPass.Circularity:1.2.0#documentType Describes type for document e.g. Dismantling manual	[String]	1

[Prop] mimeType	urn:samm:io.BatteryPass.Circularity:1.2.0#mimeType Defines internet media typ to determin how to interpret the documentURL	[String]	1
[Prop] documentURL	urn:samm:io.BatteryPass.Circularity:1.2.0#documentURL Link to document	[AnyUri]	1

```
The following values are allowed for documentType:
```

- "BillOfMaterial"
- "Model3D"
- "DismantlingManual"
- "RemovalManual"
- "OtherManual"
- "Drawing"

3.8. Properties of the SMC "sparePartSources"

34. Figure 9 shows the UML-diagram for `SMC sparePartSources`.

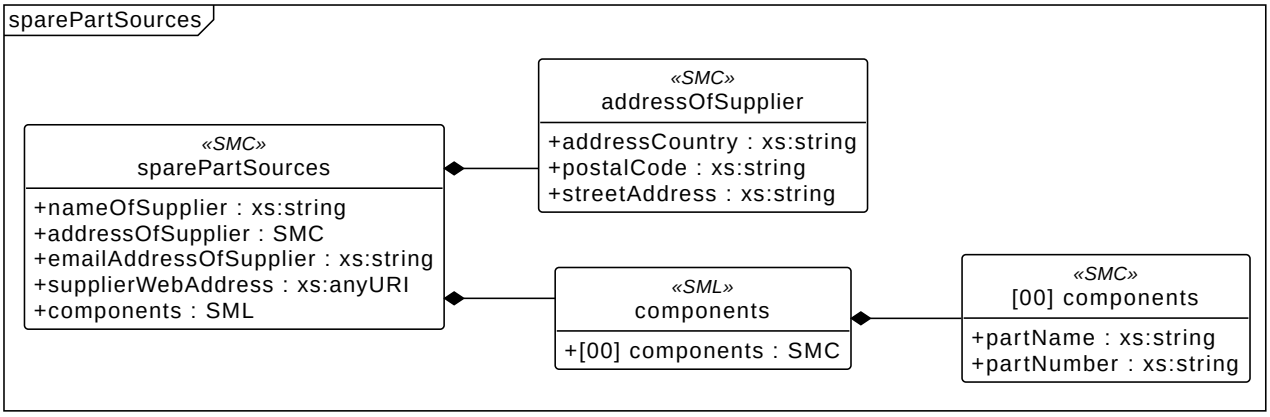

Figure 9. UML-Diagram for SML "sparePartSources"

35. Data points related to spare part sources.

idShort:	**sparePartSources**
Class:	SubmodelElementCollection
semanticId:	
Parent:	sparePartSources
Explanation:	Contact details of sources for replacement spares. Postal address, including name and brand names, postal code and place, street and number, country, telephone, if any. BR Annex XIII (2b) DIN DKE Spec 99100 chapter reference: 6.6.1.3

Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] nameOfSupplier	urn:samm:io.BatteryPass.Circularity:1.2.0#nameOfSupplier Name of Supplier	[String]	1
[SMC] addressOfSupplier	+ supplementalSemanticId: https://schema.org/PostalAddress Postal address of supplier for spare parts.	[] 3 elements	1
[Prop] emailAddressOfSupplier	urn:samm:io.BatteryPass.Circularity:1.2.0#emailAddressOfSupplier E-mail address of supplier for spare parts.	[String]	1
[Prop] supplierWebAddress	urn:samm:io.BatteryPass.Circularity:1.2.0#supplierWebAddress Web address of supplier for spare parts.	[AnyUri]	1
[SML] components	urn:samm:io.BatteryPass.Circularity:1.2.0#ComponentList Components available at supplier	[] 1 elements	1

3.9. Properties of the SMC "recycledContent"

36. Figure 10 shows the UML-diagram for `SMC recycledContent`.

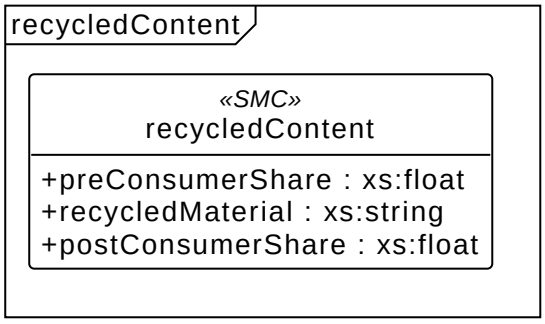

Figure 10. UML-Diagram for SML "recycledContents"

37. Data points related to recycled content.

idShort:	recycledContent
Class:	SubmodelElementCollection
semanticId:	

Parent:	recycledContent		
Explanation:	Share of material recovered from waste present in active materials for each battery model per year and per manufacturing plant. DIN DKE Spec 99100 chapter reference: 6.6.2.3 - 6.6.2.10		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] preConsumerShare	urn:samm:io.BatteryPass.Circularity:1.2.0#preConsumerShare Recycled material share from pre-consumer waste (manufacturing waste, excluding run-around scrap) of the active material.	[Float]	1
[Prop] recycledMaterial	urn:samm:io.BatteryPass.Circularity:1.2.0#recycledMaterial	[String]	1
[Prop] postConsumerShare	urn:samm:io.BatteryPass.Circularity:1.2.0#postConsumerShare Recycled material share from post-consumer waste (end-of-life scrap) of the active material.	[Float]	1

```
The following values are allowed for ´recycledMaterial´:
```

- "Cobalt"
- "Nickel" "Lithium"
- "Lead" "Cobalt"
- "Nickel"
- "Lithium"
- "Lead"

3.10. Properties of the SML "extinguishingAgent"

38. Figure 11 shows the UML-diagram for `SML extinguishingAgent`.

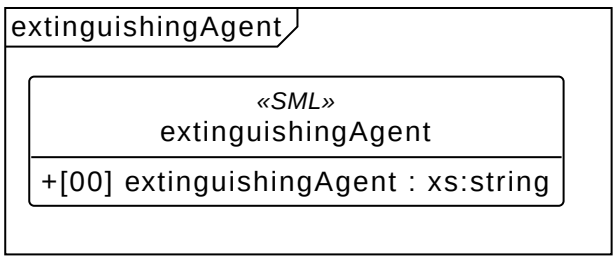

Figure 11. UML-Diagram for SML "sparePartSources"

39. List of data points related to extinguishing agent.

idShort:	**extinguishingAgent**		
Class:	SubmodelElementList		
semanticId:	urn:samm:io.BatteryPass.Circularity:1.2.0#ExtinguishingAgentsList		
Parent:	safetyMeasures		
Explanation:	Usable extinguishing agents refering to classes of extinguishers (A, B, C, D, K).EUBR: Annex XIII (1a) ? Annex VI Part A (9)		
Element details:	orderRelevant=No, typeValueListElement=Property		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] extinguishingAgent	urn:samm:io.BatteryPass.Circularity:1.2.0#extinguishingAgent Usable extinguishing agents refering to classes of extinguishers (A, B, C, D, K).EUBR: Annex XIII (1a) ? Annex VI Part A (9)	[String]	

3.11. Properties of the SMC "addressOfSupplier"

40. Figure 12 shows the UML-diagram for `SMC_addressOfSupplier`.

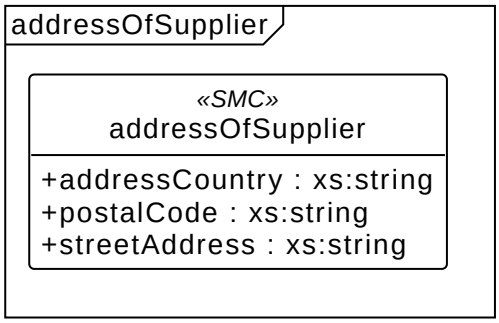

Figure 12. UML-Diagram for SMC "_addressOfSupplier"

41. Data points related to address of supplier of spare part sources.

idShort:	**addressOfSupplier**
Class:	SubmodelElementCollection
semanticId:	
Parent:	sparePartSources
Explanation:	Postal address of supplier for spare parts.
Element details:	-

[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] addressCountry	urn:samm:io.BatteryPass.Circularity:1.2.0#addressCountry supplementalSemanticId: https://schema.org/addressCountry	[String]	
[Prop] postalCode	urn:samm:io.BatteryPass.Circularity:1.2.0#postalCode supplementalSemanticId: https://schema.org/postalCode	[String]	
[Prop] streetAddress	urn:samm:io.BatteryPass.Circularity:1.2.0#streetAddress supplementalSemanticId: https://schema.org/streetAddress	[String]	

3.12. Properties of the SML "components"

42. Figure 13 shows the UML-diagram for `SML components`.

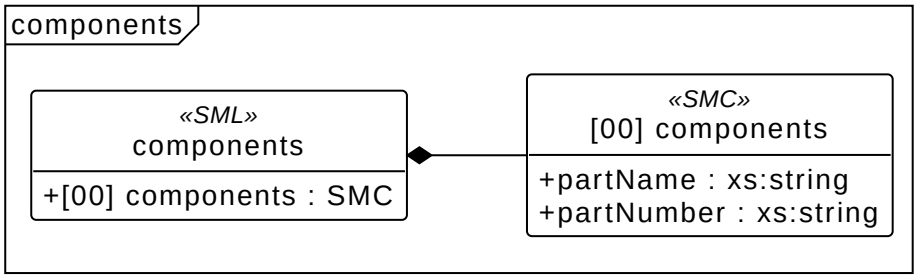

Figure 13. UML-Diagram for SML "componentsr"

43. List of data points related to components of spare part sources.

idShort:	**components**		
Class:	SubmodelElementList		
semanticId:	urn:samm:io.BatteryPass.Circularity:1.2.0#ComponentList		
Parent:	sparePartSources		
Explanation:	Components available at supplier		
Element details:	orderRelevant=No, typeValueListElement=SubmodelElementCollection		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[SMC] components	+ Components available at supplier	[] 2 elements	

3.13. Properties of the SMC "components"

44. Figure 14 shows the UML-diagram for `SMC components`.

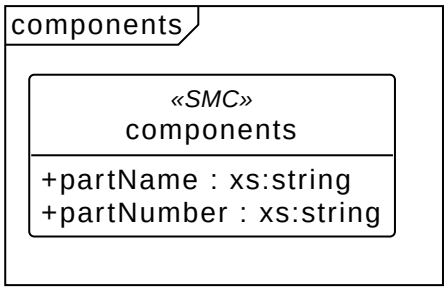

Figure 14. UML-Diagram for SMC "componentsr"

45. Data points related to components of spare part sources.

idShort:	**components**		
Class:	SubmodelElementCollection		
semanticId:			
Parent:	components		
Explanation:	Components available at supplier		
Element details:	-		
[SME type] idShort	semanticId Description@en	[valueType] example	card.
[Prop] partName	urn:samm:io.BatteryPass.Circularity:1.2.0#partName	[String]	1
[Prop] partNumber	urn:samm:io.BatteryPass.Circularity:1.2.0#partNumber Part Number of Component	[String]	1

Annex A. Explanations on used table formats

1. General

46. 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

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

- 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.
- The types of SubmodelElements are abbreviated (see Table 1):

Table 1. 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
SML	SubmodelElementList

- 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.

Annex B. Changes to the submodel template

General

48. This annex lists the changes from version to version of the Submodel, together with major changes in the overall document.

Changes Version 1.0

- First Version conformant to DIN SPEC 99100

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