

IDTA 02023-0-9 Carbon Footprint

November 2023

SPECIFICATION

Submodel Template of the
Asset Administration Shell



Submodel Template

IDTA approved

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

Imprint

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1 General

1.1 About this Document

This document is a part of a specification series. Each part specifies the contents of a Submodel template for the Asset Administration Shell (AAS). The AAS is described in [1], [2], [3] and [6]. First exemplary Submodel contents were described in [4], while the actual format of this document was derived by the "Administration Shell in Practice" [5]. The format aims to be very concise, giving only minimal necessary information for applying a Submodel template, while leaving deeper descriptions and specification of concepts, structures and mapping to the respective documents [1] to [6].

The target group of the specification are developers and editors of technical documentation and manufacturer information, which are describing assets in smart manufacturing by means of the 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.

1.2 Scope of the Submodel

This Submodel template provides the means to exchange an asset's Carbon Footprint (CF) between the partners along a value chain. The aim of this Submodel is to increase the interoperability between the parties, who are interested in documenting, exchanging, evaluating, or optimizing the environmental footprint of their assets. These parties can for example be manufacturers, users/consumers, or logistic partners. The CF might be part of larger initiatives such as the Digital Product Passport (DPP) or the Product Environmental Footprint. It is not the scope of this Submodel template to substitute the relevant certificates. Use cases with increasing complexity are described in the following section. The first version of this document will focus on Use Case 1 and 2 only. Additional use cases will be supported in future versions.

1.3 Use cases, Requirements and Design Decisions

Use Case 1 "Communication of Carbon Footprints – limited machine readable"

Based on the digital nameplate of an asset, users should be able to view relevant Carbon Footprint information by scanning the product and downloading further information (e.g., as a PDF or a link to a website) for detailed analysis. In addition to a few meta-information within the AAS related to the footprint, manufacturers can simply link the existing documentation (required by ISO 14026) for this purpose.



Figure 1: Use Case 1 Illustration

Use Case 2 “Passing CFs through the value chain for integrated calculation”

For automated summation of the CF, additional meta-information must be available to classify the scope and quality of the footprint information. For this purpose, the ZVEI demonstrator PCF@ControlCabinet was used as a field-tested example of such a value network to derive requirements for the Submodel template. The object of this demonstrator was the integration of more than 100 components from more than 10 different manufacturers into a control cabinet. The objective was to dynamically calculate the Product Carbon Footprint (PCF) of the control cabinet based on the AAS, which exchange sustainability information across business partners in the value network. Different calculation methods and scopes had to be considered. More information about the demonstrator and the use cases can be found in the discussion paper [7].

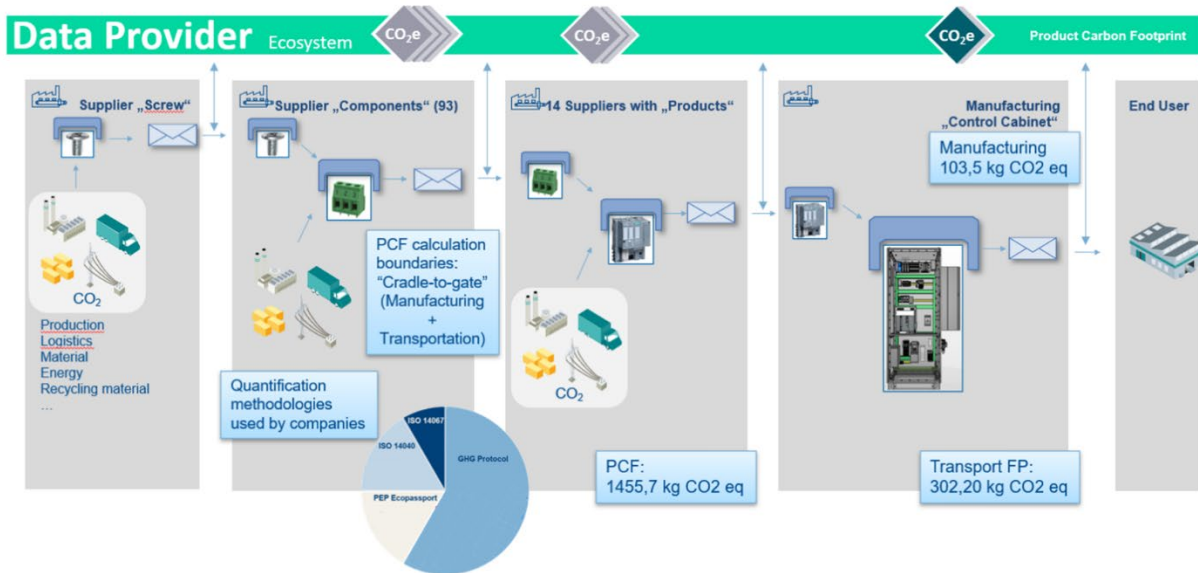


Figure 2: Use Case 2 Illustration based on PCF@ControlCabinet, Source ZVEI

Design Decisions for Use Case 1 and Use Case 2

Different standards and proprietary methods for calculating PCF values exist with varying complexity and different approximation assumptions. Sometimes the overall PCF is of interest (“from cradle to grave”) and sometimes only the value for certain lifecycle phases. Also depending on the use case certain effects need to be included or excluded from the calculation. Therefore, the Submodel template allows to provide multiple PCF values using different calculating methods and assumptions. The basic design of the Submodel template is therefore that an unlimited number of SubmodelElementCollections (SMC) can be listed. Thereby, each SMC can address the carbon footprint using a different standard, calculation method or assumption. This specification will list a growing number of supported standards.

In addition to general standards for life cycle assessments (e.g., ISO 14044) and footprint calculations (e.g., ISO 14067 or Greenhouse Gas Protocol, ...), other standards are also included in the carbon footprint calculation and communication. However, these standards do not contain any concrete specifications on how exactly the PCF is to be determined for individual products or transport routes. In the lack of such rules, the CFs of the same products from different companies are not yet fully comparable. IDTA supports the introduction of product category rules for the calculation in various industries to enable the same basis for the calculation and thus a comparability and standardized description of the products.

Therefore, the working group was guided by a step-by-step model to develop a first specification in order to integrate future levels of detail and industry-, and product-specific requirements (Figure 3).

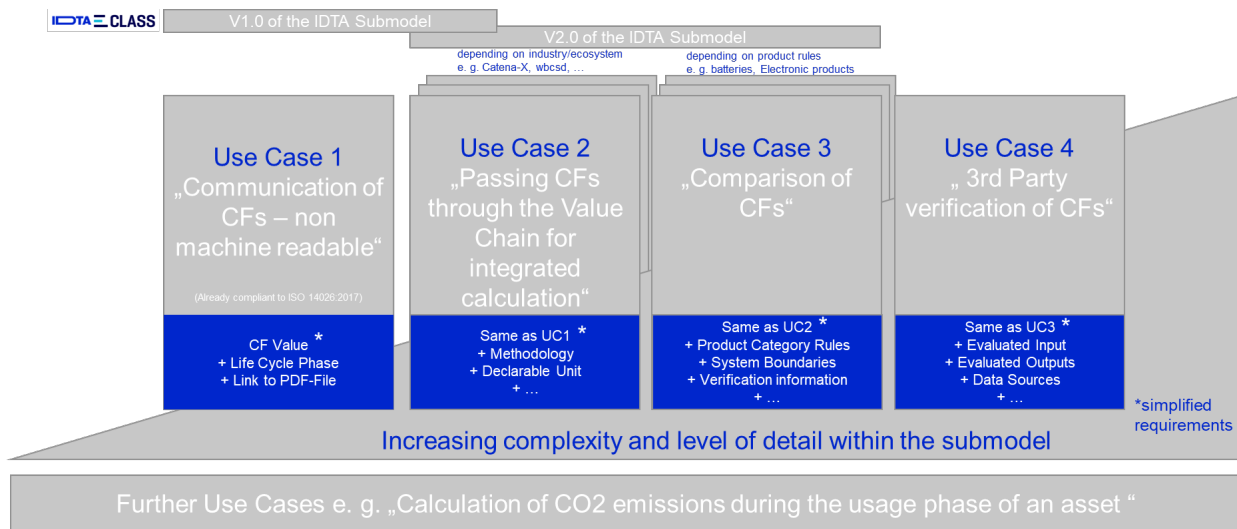


Figure 3: Stage model for carbon footprint use cases and the Submodel scope

1.4 Relevant standards for the Submodel Template

Due to the large number of standards, some of which are being developed in parallel, this is only a selection of specifications that have been reviewed. Close coordination, as shown in Figure 3, is the aim within this working group.

ECLASS

ECLASS is a classification system for products and services maintained by the industry consortium ECLASS e.V. It supports the digital exchange of product descriptions and service descriptions, in the form of standardized data formats based on IEC 61360. As of ECLASS Release 13.0 a set of property definitions for PCF modelling is provided. As of ECLASS Release 14.0 the modelling was adapted such that these properties are part of a larger set of environmental properties.

ISO 14067 - Greenhouse gases – Carbon footprint of products

This document specifies principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product, in a manner consistent with the standards on life cycle assessment (LCA). Requirements and guidelines for the quantification of a partial CF are also specified. This document is applicable to CF studies, the results of which provide the basis for different applications.

ISO 14040, 14044 - Environmental management – Life cycle assessment

These documents describe requirements, guidelines, principles and frameworks for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements.

EN 15804 - Building Sustainability – Environmental Product Declarations – Basic Rules for the Product Category of Building Products

The standard ensures that all Environmental Product Declarations (EPDs) for building products, building services, and building processes are derived, verified, and represented in a uniform manner. It stipulates the fundamental product category rules.

EN 16258 - Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)

This European Standard establishes a common methodology for the calculation and declaration of energy consumption and greenhouse gas (GHG) emissions related to any transport service (of freight, passengers or both).

IEC TS 63058 - Switchgear and controlgear and their assemblies for low voltage – Environmental aspects

This standard provides guidance to manufacturers of low-voltage switchgear and controlgear and their assemblies in evaluating and improving the environmental impact of their products, and in enabling effective communication using common references for environmental information throughout the supply chain.

GHG Protocol - Greenhouse Gas Protocol

GHG Protocol establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions.

PEP Ecopassport - Product Environmental Profile Ecopassport

The mission of the non-profit P.E.P. Association is to develop internationally the Environmental declaration Program PEP Ecopassport® concerning electrical, electronic and HVAC (heating, ventilation, air-conditioning, refrigeration) products. The Ecopassport provides a reference framework in compliance with the ISO 14025 and ISO 14040 standards.

World Business Council for Sustainable Development

The World Business Council for Sustainable Development (WBCSD) is a community of over 200 sustainable businesses working collectively to accelerate the system transformations needed for a net-zero, nature positive, and more equitable future. Among others the WBCSD creates technical specifications to enable the exchange of standardized GHG data at product level across interoperable technology solutions.

Catena-X

Catena-X is an integrated, collaborative, open data ecosystem for the automotive industry. It connects all players to end-to-end value chains. As part of its standardization activities a semantic data model for the PCF has been published as CX - 0026 and can be found at <https://catena-x.net/de/standard-library>.

2 Submodel Template Carbon Footprint (CF)

2.1 Approach

The basic design of the Submodel template is that an unlimited number of SubmodelElementCollections (SMC) can be listed. Thereby, each SMC can address the carbon footprint using a different standard, calculation method or assumption.

This pre-release version v0.9 of the Submodel specification focusses on the model based on ECLASS Release v13.0. The ECLASS model distinguishes between the Product Carbon Footprint (PCF) and the Transport Carbon Footprint (TCF) calculation. It currently supports EN 15804, ISO 14040, ISO 14044, ISO 14067, IEC TS 63058, GHG Protocol, PEP Ecopassport® for the PCF and EN 16258 for the TCF. Further planned versions of the Submodel are shown in Figure 3.

The structure and properties of the model are based on the ECLASS block CarbonFootprint (0173-1#01-AHE712#001). However, the block’s IRDI is not used in this Submodel template, because of the introduction of the additional property “ExplanatoryStatement”.

The general structure of the Submodel is given in Figure 4.

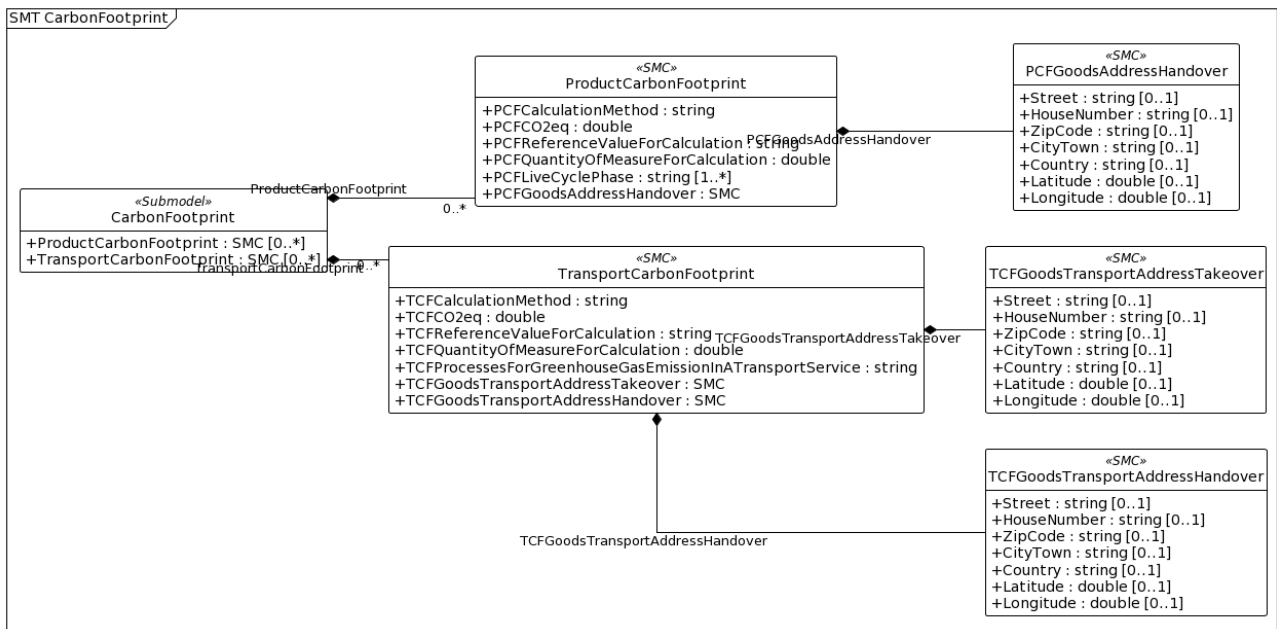


Figure 4: Submodel template overview

Important:

This version is a pre-release. It can and should be used as a common basis for demonstrators, proof-of-concepts, trainings, etc. **It should not be used productively.** The upcoming release version v1.0 is expected to be different and incompatible to this pre-release.

This submodel template specification v0.9 is simple to use and contains the major properties relevant for communicating a carbon footprint. However, the topic of modelling the environmental footprint is still a moving target in the relevant standardisation organizations. A lot has happened since the work on this specification has started and the upcoming version v1.0 will reflect the newest developments.

2.2 Carbon Footprint Submodel Template

Table 1: Carbon Footprint Submodel Template

idShort:	CarbonFootprint Note: a different idShort might be used, as long as it is unique in the Asset Administration Shell.		
Class:	Submodel (SM)		
semanticId:	[IRI] https://admin-shell.io/idta/CarbonFootprint/CarbonFootprint/0/9		
Parent:	Asset Administration Shell, to which the Carbon Footprint shall be associated to		
Explanation:	The Submodel provides the means to access the Carbon Footprint of the asset.		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[SMC] ProductCarbonFootprint{00}	[IRI] https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprint/0/9 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	n/a	0..*
[SMC] TransportCarbonFootprint{00}	[IRI] https://admin-shell.io/idta/CarbonFootprint/TransportCarbonFootprint/0/9 Balance of greenhouse gas emissions generated by a transport service of a product	n/a	0..*

2.3 SMC Product Carbon Footprint Calculation (PCF)

This SMC provides the means to access the Product Carbon Footprint (PCF) of the asset. If several different calculation methods or lifecycle phases are to be supplied with the submodel, multiple instances of this SMC should be instantiated.

In this SMC the PCF requires that the appropriate lifecycle phase for which the CO₂-equivalent has been calculated is stated. Since not all standards support all life cycle phases it is possible to create an inconsistent model by stating standard and lifecycle phases that do not match. (The template does not contain a cross-check.) It is assumed that the creator of the respective model instances is knowledgeable in the field.

Table 2: SMC Product Carbon Footprint

idShort:	ProductCarbonFootprint{00}																				
	Note: a different idShort might be used, as long as it is unique in the Submodel.																				
Class:	SubmodelElementCollection (SMC)																				
semanticId:	[[IRDI]] https://admin-shell.io/idta/CarbonFootprint/ProductCarbonFootprint/0/9																				
Parent:	SM CarbonFootprint (https://admin-shell.io/idta/CarbonFootprint/CarbonFootprint/0/9)																				
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																				
[SME type]	semanticId = [idType]value	[valueType]	card.																		
idShort	Description@en	Example																			
[Property]	[IRDI] 0173-1#02-ABG854#002	String	1..*																		
PCFCalculation Method	Standard, method for determining the greenhouse gas emissions of a product Value List	"ISO 14067"																			
	<table border="1"> <thead> <tr> <th>value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>EN 15804</td> <td>0173-1#07-ABU223#002</td> </tr> <tr> <td>GHG Protocol</td> <td>0173-1#07-ABU221#002</td> </tr> <tr> <td>IEC TS 63058</td> <td>0173-1#07-ABU222#002</td> </tr> <tr> <td>ISO 14040</td> <td>0173-1#07-ABV505#002</td> </tr> <tr> <td>ISO 14044</td> <td>0173-1#07-ABV506#002</td> </tr> <tr> <td>ISO 14067</td> <td>0173-1#07-ABU218#002</td> </tr> <tr> <td>IEC 63366</td> <td>0173-1#07-ACA792#001</td> </tr> <tr> <td>PEP Ecopassport</td> <td>0173-1#07-ABU220#002</td> </tr> </tbody> </table>	value	valueId	EN 15804	0173-1#07-ABU223#002	GHG Protocol	0173-1#07-ABU221#002	IEC TS 63058	0173-1#07-ABU222#002	ISO 14040	0173-1#07-ABV505#002	ISO 14044	0173-1#07-ABV506#002	ISO 14067	0173-1#07-ABU218#002	IEC 63366	0173-1#07-ACA792#001	PEP Ecopassport	0173-1#07-ABU220#002		
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EN 15804	0173-1#07-ABU223#002																				
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ISO 14067	0173-1#07-ABU218#002																				
IEC 63366	0173-1#07-ACA792#001																				
PEP Ecopassport	0173-1#07-ABU220#002																				
	Note 1: Multiple standards can be listed in the SMC in case these standards are all applied for the respective PCF calculation, e.g. if standard A lists standard B as normative. If different calculation rules with different footprint results need to be documented multiple instances of this SMC should be created.																				

	Note 2: The usage of values that are not given in this table is possible, but not recommended, because this would reduce the compatibility.																				
[Property] PCFCO2eq	[IRDI] 0173-1#02-ABG855#001 Sum of all greenhouse gas emissions of a product according to the quantification requirements of the standard	Double [kg] 17.2	1																		
[Property] PCFReferenceValueForCalculation	[IRDI] 0173-1#02-ABG856#001 Quantity unit of the product to which the PCF information on the CO ₂ footprint refers Value List <table border="1" data-bbox="343 600 933 1039"> <thead> <tr> <th>value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>g</td> <td>0173-1#07-ABZ596#001</td> </tr> <tr> <td>kg</td> <td>0173-1#07-ABZ597#001</td> </tr> <tr> <td>t</td> <td>0173-1#07-ABZ598#001</td> </tr> <tr> <td>ml</td> <td>0173-1#07-ABZ599#001</td> </tr> <tr> <td>l</td> <td>0173-1#07-ABZ600#001</td> </tr> <tr> <td>cbm</td> <td>0173-1#07-ABZ601#001</td> </tr> <tr> <td>qm</td> <td>0173-1#07-ABZ602#001</td> </tr> <tr> <td>piece</td> <td>0173-1#07-ABZ603#001</td> </tr> </tbody> </table> Note 1: The usage of values that are not given in this table is possible, but not recommended, because this would reduce the compatibility.	value	valueId	g	0173-1#07-ABZ596#001	kg	0173-1#07-ABZ597#001	t	0173-1#07-ABZ598#001	ml	0173-1#07-ABZ599#001	l	0173-1#07-ABZ600#001	cbm	0173-1#07-ABZ601#001	qm	0173-1#07-ABZ602#001	piece	0173-1#07-ABZ603#001	String "piece"	1
value	valueId																				
g	0173-1#07-ABZ596#001																				
kg	0173-1#07-ABZ597#001																				
t	0173-1#07-ABZ598#001																				
ml	0173-1#07-ABZ599#001																				
l	0173-1#07-ABZ600#001																				
cbm	0173-1#07-ABZ601#001																				
qm	0173-1#07-ABZ602#001																				
piece	0173-1#07-ABZ603#001																				
[Property] PCFQuantityOfMeasureForCalculation	[IRDI] 0173-1#02-ABG857#001 Quantity of the product to which the PCF information on the CO ₂ footprint refers	Double 5.0	1																		
[Property] PCFLifeCyclePhase	[IRDI] 0173-1#02-ABG858#001 Life cycle stages of the product according to the quantification requirements of the standard to which the PCF carbon footprint statement refers Value List <table border="1" data-bbox="343 1563 1120 2018"> <thead> <tr> <th>value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>A1 - raw material supply (and upstream production)</td> <td>0173-1#07-ABU208#001</td> </tr> <tr> <td>A2 - cradle-to-gate transport to factory</td> <td>0173-1#07-ABU209#001</td> </tr> <tr> <td>A3 - production</td> <td>0173-1#07-ABU210#001</td> </tr> <tr> <td>A4 - transport to final destination</td> <td>0173-1#07-ABU211#001</td> </tr> <tr> <td>B1 - usage phase</td> <td>0173-1#07-ABU212#001</td> </tr> <tr> <td>B2 - maintenance</td> <td>0173-1#07-ABV498#001</td> </tr> <tr> <td>B3 - repair</td> <td>0173-1#07-ABV497#001</td> </tr> </tbody> </table>	value	valueId	A1 - raw material supply (and upstream production)	0173-1#07-ABU208#001	A2 - cradle-to-gate transport to factory	0173-1#07-ABU209#001	A3 - production	0173-1#07-ABU210#001	A4 - transport to final destination	0173-1#07-ABU211#001	B1 - usage phase	0173-1#07-ABU212#001	B2 - maintenance	0173-1#07-ABV498#001	B3 - repair	0173-1#07-ABV497#001	String "C4 - landfill"	1..*		
value	valueId																				
A1 - raw material supply (and upstream production)	0173-1#07-ABU208#001																				
A2 - cradle-to-gate transport to factory	0173-1#07-ABU209#001																				
A3 - production	0173-1#07-ABU210#001																				
A4 - transport to final destination	0173-1#07-ABU211#001																				
B1 - usage phase	0173-1#07-ABU212#001																				
B2 - maintenance	0173-1#07-ABV498#001																				
B3 - repair	0173-1#07-ABV497#001																				

	<table border="1"> <tbody> <tr> <td>B5 - update/upgrade, refurbishing</td> <td>0173-1#07-ABV499#001</td> </tr> <tr> <td>B6 - usage energy consumption</td> <td>0173-1#07-ABV500#001</td> </tr> <tr> <td>B7 - usage water consumption</td> <td>0173-1#07-ABV501#001</td> </tr> <tr> <td>C1 - reassembly</td> <td>0173-1#07-ABV502#001</td> </tr> <tr> <td>C2 - transport to recycler</td> <td>0173-1#07-ABU213#001</td> </tr> <tr> <td>C3 - recycling, waste treatment</td> <td>0173-1#07-ABV503#001</td> </tr> <tr> <td>C4 - landfill</td> <td>0173-1#07-ABV504#001</td> </tr> <tr> <td>D - reuse</td> <td>0173-1#07-ABU214#001</td> </tr> <tr> <td>A1-A3</td> <td>0173-1#07-ABZ789#001</td> </tr> </tbody> </table> <p>Note 1: Multiple lifecycle phases can be listed in the SMC. The interpretation is that the calculated PCF value is the sum of the PCF that has been produced in all the listed lifecycle phases. If the PCF value needs to be supplied for each lifecycle phase separately, multiple SMCs should be created instead.</p> <p>Note 2: The usage of values that are not given in this table is possible, but not recommended, because this would reduce the compatibility.</p>	B5 - update/upgrade, refurbishing	0173-1#07-ABV499#001	B6 - usage energy consumption	0173-1#07-ABV500#001	B7 - usage water consumption	0173-1#07-ABV501#001	C1 - reassembly	0173-1#07-ABV502#001	C2 - transport to recycler	0173-1#07-ABU213#001	C3 - recycling, waste treatment	0173-1#07-ABV503#001	C4 - landfill	0173-1#07-ABV504#001	D - reuse	0173-1#07-ABU214#001	A1-A3	0173-1#07-ABZ789#001		
B5 - update/upgrade, refurbishing	0173-1#07-ABV499#001																				
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C3 - recycling, waste treatment	0173-1#07-ABV503#001																				
C4 - landfill	0173-1#07-ABV504#001																				
D - reuse	0173-1#07-ABU214#001																				
A1-A3	0173-1#07-ABZ789#001																				
[File] ExplanatoryStatement	<p>[IRI] https://admin-shell.io/idta/CarbonFootprint/ExplanatoryStatement/1/0</p> <p>definition@en: Explanation which is needed or given so that a footprint communication can be properly understood by a purchaser, potential purchaser or user of the product</p> <p>definition@de: Erforderliche oder vorhandene Erklärung, um sicherzustellen, dass eine Fußabdruckkommunikation von einem Käufer, potentiellen Käufer oder Anwender des Produktes richtig verstanden werden kann</p>	Statement.pdf	0..1																		
[SMC] PCFGoodsAddressHandover	<p>[IRDI] 0173-1#02-ABI497#001</p> <p>Indicates the place of hand-over of the goods (use structure defined in section 2.5 SMC Address)</p>	n/a	1																		
[Property] PublicationDate	<p>[IRI] https://admin-shell.io/idta/CarbonFootprint/PublicationDate/1/0</p> <p>Time at which something was first published or made available</p>	Date	1																		
[Property] ExpirationDate	<p>[IRI] https://admin-shell.io/idta/CarbonFootprint/ExpirationDate/1/0</p> <p>Time at which something should no longer be used effectively because it may lose its validity, quality or safety</p>	Date	0..1																		

2.4 SMC Transport Carbon Footprint Calculation (TCF)

This SMC provides the means to access the Transport Carbon Footprint (TCF) of the asset. If several different calculation methods or processes are to be supplied with the submodel, multiple instances of this SMC should be instantiated.

Table 3: SMC Transport Carbon Footprint

idShort:	TransportCarbonFootprint{00}																				
	Note: a different idShort might be used, as long as it is unique in the Submodel.																				
Class:	SubmodelElementCollection (SMC)																				
semanticId:	[IRDI] https://admin-shell.io/idta/CarbonFootprint/TransportCarbonFootprint/0/9																				
Parent:	SM CarbonFootprint (https://admin-shell.io/idta/CarbonFootprint/CarbonFootprint/0/9)																				
Explanation:	Balance of greenhouse gas emissions generated by a transport service of a product.																				
[SME type]	semanticId = [idType]value	[valueType]	card.																		
idShort	Description@en	Example																			
[Property]	[IRDI] 0173-1#02-ABG859#002	String	1																		
TCFCalculation Method	Standard, method for determining the greenhouse gas emissions for the transport of a product	“EN 16258”																			
	Value List																				
	<table border="1"> <thead> <tr> <th>value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>EN 16258</td> <td>0173-1#07-ABU224#001</td> </tr> </tbody> </table>	value	valueId	EN 16258	0173-1#07-ABU224#001																
value	valueId																				
EN 16258	0173-1#07-ABU224#001																				
[Property]	[IRDI] 0173-1#02-ABG860#001	Double [kg]	1																		
TCFCO2eq	Sum of all greenhouse gas emissions from vehicle operation	5.3																			
[Property]	[IRDI] 0173-1#02-ABG861#002	String	1																		
TCFReferenceValueForCalculation	Amount of product to which the TCF carbon footprint statement relates	“piece”																			
	Value List																				
	<table border="1"> <thead> <tr> <th>value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>g</td> <td>0173-1#07-ABZ596#001</td> </tr> <tr> <td>kg</td> <td>0173-1#07-ABZ597#001</td> </tr> <tr> <td>t</td> <td>0173-1#07-ABZ598#001</td> </tr> <tr> <td>ml</td> <td>0173-1#07-ABZ599#001</td> </tr> <tr> <td>l</td> <td>0173-1#07-ABZ600#001</td> </tr> <tr> <td>cbm</td> <td>0173-1#07-ABZ601#001</td> </tr> <tr> <td>qm</td> <td>0173-1#07-ABZ602#001</td> </tr> <tr> <td>piece</td> <td>0173-1#07-ABZ603#001</td> </tr> </tbody> </table>	value	valueId	g	0173-1#07-ABZ596#001	kg	0173-1#07-ABZ597#001	t	0173-1#07-ABZ598#001	ml	0173-1#07-ABZ599#001	l	0173-1#07-ABZ600#001	cbm	0173-1#07-ABZ601#001	qm	0173-1#07-ABZ602#001	piece	0173-1#07-ABZ603#001		
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g	0173-1#07-ABZ596#001																				
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cbm	0173-1#07-ABZ601#001																				
qm	0173-1#07-ABZ602#001																				
piece	0173-1#07-ABZ603#001																				

[Property]	[IRDI] 0173-1#02-ABG862#001	Double	1								
TCFQuantityOfMeasureForCalculation	Quantity of the product to which the TCF information on the CO ₂ footprint refers										
[Property]	[IRDI] 0173-1#02-ABG863#002	String	1..n								
TCFProcessesForGreenhouseGasEmissionInAirTransportService	Processes in a transport service to determine the sum of all direct or indirect greenhouse gas emissions from fuel supply and vehicle operation Value List	"WTT - Well-to-Tank"									
	<table border="1"> <thead> <tr> <th>Value</th> <th>valueId</th> </tr> </thead> <tbody> <tr> <td>WTT - Well-to-Tank</td> <td>0173-1#07-ABU216#001</td> </tr> <tr> <td>TTW - Tank-to-Wheel</td> <td>0173-1#07-ABU215#001</td> </tr> <tr> <td>WTW - Well-to-Wheel</td> <td>0173-1#07-ABU217#001</td> </tr> </tbody> </table>	Value	valueId	WTT - Well-to-Tank	0173-1#07-ABU216#001	TTW - Tank-to-Wheel	0173-1#07-ABU215#001	WTW - Well-to-Wheel	0173-1#07-ABU217#001		
Value	valueId										
WTT - Well-to-Tank	0173-1#07-ABU216#001										
TTW - Tank-to-Wheel	0173-1#07-ABU215#001										
WTW - Well-to-Wheel	0173-1#07-ABU217#001										
[File]	[IDRI] https://admin-shell.io/idta/CarbonFootprint/ExplanatoryStatement/1/0	Statement.pdf	0..1								
ExplanatoryStatement	<p>definition@en: Explanation which is needed or given so that a footprint communication can be properly understood by a purchaser, potential purchaser or user of the product</p> <p>definition@de: Erforderliche oder vorhandene Erklärung, um sicherzustellen, dass eine Fußabdruckkommunikation von einem Käufer, potenziellen Käufer oder Anwender des Produktes richtig verstanden werden kann</p>										
[SMC]	[IRDI] 0173-1#02-ABI499#001	n/a	1								
TCFGoodsTransportAddressTakeover	Indication of the place of receipt of goods (use structure defined in 2.5 SMC Address)										
[SMC]	[IRDI] 0173-1#02-ABI498#001	n/a	1								
TCFGoodsTransportAddressHandover	Indicates the hand-over address of the goods transport (use structure defined in 2.5 SMC Address)										
[Property]	[IRI] https://admin-shell.io/idta/CarbonFootprint/PublicationDate/1/0	Date	1								
PublicationDate	Time at which something was first published or made available										
[Property]	[IRI] https://admin-shell.io/idta/CarbonFootprint/ExpirationDate/1/0	Date	0..1								
ExpirationDate	Time at which something should no longer be used effectively because it may lose its validity, quality or safety										

2.5 SMC Address

This SMC supplies a structure for denoting addresses as part of the CF declaration.

Table 4: SMC Address

idShort:	TCFGoodsTransportAddressTakeover or TCFGoodsTransportAddressHandover		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRDI] 0173-1#02-ABI499#001 or [IRDI] 0173-1#02-ABI498#001		
Parent:	ProductCarbonFootprint and TransportCarbonFootprint		
Explanation:	Structure to be reused for denoting addresses		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[Property]	[IRDI] 0173-1#02-ABH956#001	String	0..1
Street	Street indication of the place of transfer of goods	"Myroad"	
[Property]	[IRDI] 0173-1#02-ABH957#001	String	0..1
HouseNumber	Number for identification or differentiation of individual houses of a street	"1a"	
[Property]	[IRDI] 0173-1#02-ABH958#001	String	0..1
ZipCode	Zip code of the goods transfer address	"12345"	
[Property]	[IRDI] 0173-1#02-ABH959#001	String	0..1
CityTown	Indication of the city or town of the transfer of goods	"Mytown"	
[Property]	[IRDI] 0173-1#02-AAO259#005	String	0..1
Country	Country where the product is transmitted	"Mycountry"	

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 [] from 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:

SME type	SubmodelElement type
Property	Property
MLP	MultiLanguageProperty
Range	Range
File	File
Blob	Blob
Ref	ReferenceElement
Rel	RelationshipElement
SMC	SubmodelElementCollection

- 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 chosen, 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: [IRI]https://admin-shell.io/vdi/2770/1/0/DocumentId/Id. The attributes "type" and "local" (typically "ConceptDescription" and "(local)" or "GlobalReference" and "(no-local)") 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.
- For some properties a valueList is given, meaning that only values from this list should be used. It is recommended to use the given valueID as reference. If both, the value and the valueID are present then the value needs to be identical to the value of the referenced coded value in valueID.

3. Abbreviations

- EPD Environmental Product Declarations
- GHG Greenhouse Gas
- IRDI International Registration Data Identifier
- PCF Product Carbon Footprint
- TCF Transport Carbon Footprint
- WBCSD World Business Council for Sustainable Development

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