BS 8541-6:2015

BSI Standards Publication

Library objects for architecture, engineering and construction –

Part 6: Product and facility declarations – Code of practice

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Contents

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This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 34, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 8541 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 March 2015. It was prepared by Technical Committee B/555, *Construction design, modelling and data exchange*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other publications

BS 8541 comprises six parts as follows:

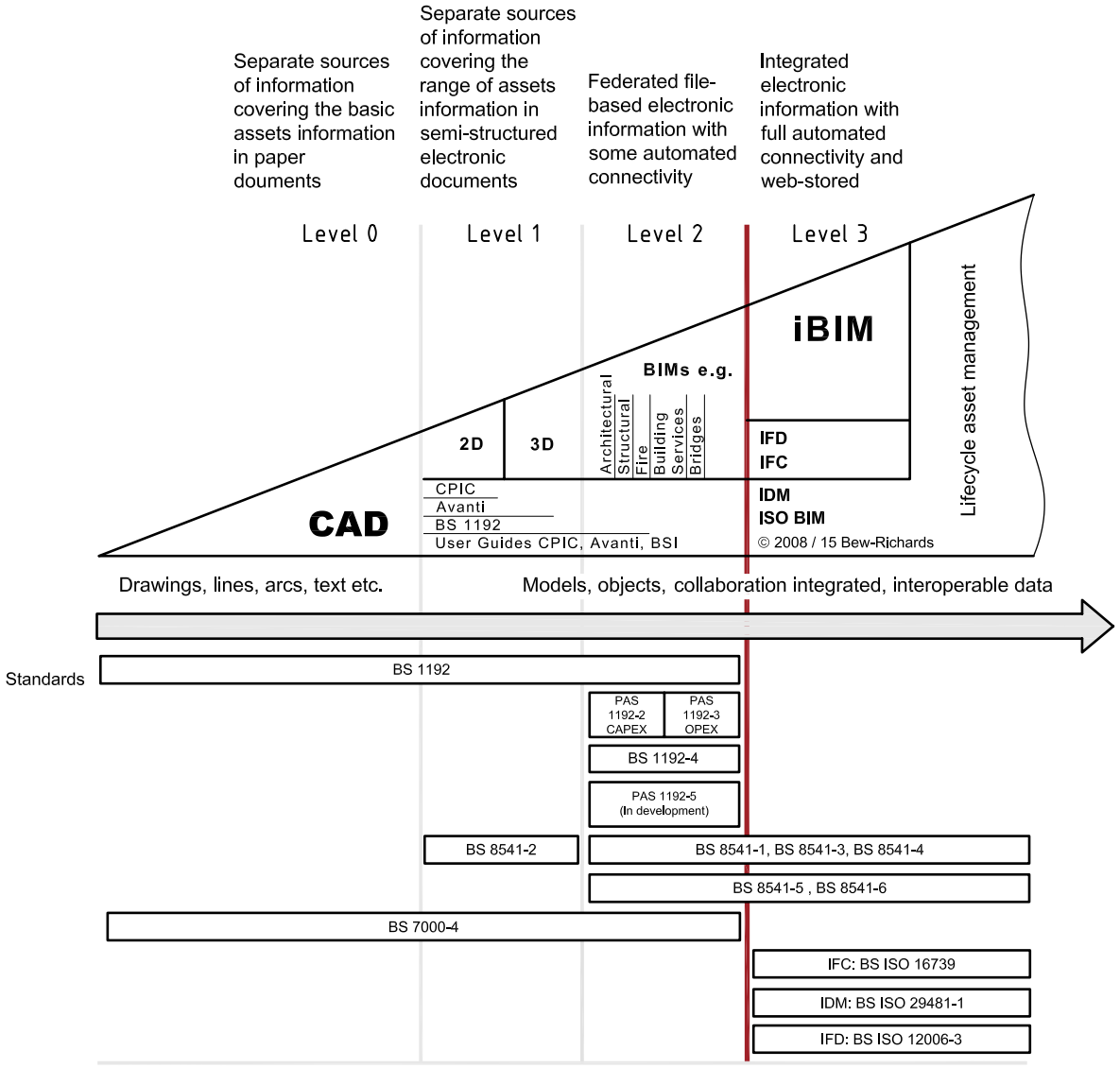
- Part 1, *Identification and classification*
- Part 2, *Recommended 2D symbols of building elements for use in building information modelling*
- Part 3, *Shape and measurement*
- Part 4, *Attributes for specification and assessment*
- Part 5, *Assemblies*
- Part 6 (this part), *Product and facility declarations*

BS 8541-1, BS 8541-3 and BS 8541-4 document best practice for the development and application of construction library objects to support Building Information Modelling (BIM) based design, standardization, specification and construction processes. See BS 8541-1 and Figure 1.

BS 8541-2 documents best practice for the use of 2D symbols for construction objects. BS 8541-5 and BS 8541-6 document best practice for the transmission of assemblies of construction objects and for the transmission of formal performance declarations of products and facilities.

The IFC standard (BS ISO 16739) includes recommendations for the association of base quantities and geometry for objects. The use of the IFC standard can be supplemented by using UK specific recommendations, such as are published by buildingSMART UK on behalf of RIBAE NBS under its UK national BIM Library initiative. For further information on work within ISO, see BS 8541-1.

Figure 1 **Core maturity model**



NOTE The BIM reports and an updated Roadmap are maintained by BIS[1)].

Use of this document

As a code of practice, this part of BS 8541 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 8541 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

1) http://shop.bsigroup.com/bim [viewed: 24-3-2015]

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 8541 gives recommendations on the transmission of product declarations relating to construction library objects and facility declarations (including buildings, infrastructure and built assets). It applies primarily to manufacturers' specific products, but the principles and some examples are also applicable to facility declarations.

NOTE 1 Independent declarations are an increasingly important aspect of product and facility data, covering environmental and other performance.

This part of BS 8541 gives recommendations on conveying declarations as part of a standard product data set (supplementary to printed labels, annexes and document lodgement) and integrates product and facility declarations into information-driven design, construction and operational processes.

This part of BS 8541 is applicable to any independent declaration scheme and establishes principles for the identification of declarations and their origin. It defines the level of information appropriate for specific uses including confirmation, reporting, and analysis. The intent is to allow any declaration to be communicated with indications as to the degree of attestation offered. The specific values declared are given in the context of a specific declaration scheme and supported with details of the relevant life cycle stage and details of its scenario.

NOTE 2 Construction products regulations and CEN standards for buildings and products provide the primary examples. This part of BS 8541 supports the communication of the voluntary environmental product declarations (EPDs) required by BS EN 15804 and BS EN 15978, as well as the CE marking details, in a format which can be incorporated in Building Information Modelling (BIM) processes. It also covers the communication of other product declarations such as wastage rates developed with the UK Government WRAP programme and UK government display energy certificate (DEC) declaration scheme.

NOTE 3 COBie, BS ISO 16739 IFC and IFCXML are used as example formats with reference to BS ISO 10303-21 and ISO/TS 10303-28. These formats can be mapped to standard printed forms if required.

NOTE 4 In situations where the adoption of data-driven design is partial or incomplete, this part of BS 8541 gives further recommendations. If a particular project is formally committed to integrated working then this standard may be adopted as a requirement.

NOTE 5 Self-declared environmental claims (such as described as Type II environmental labels in BS EN ISO 14021) have the lowest degree of attestation but are also covered by this standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 8541-1, *Library objects for architecture, engineering and construction – Part 1: Identification and classification – Code of practice*

BS 8541-2, *Library objects for architecture, engineering and construction – Part 2: Recommended 2D symbols of building elements for use in building information modelling*

BS 8541-3, *Library objects for architecture, engineering and construction – Part 3: Shape and measurement – Code of practice*

BS 8541-4, *Library objects for architecture, engineering and construction – Part 4: Attributes for specification and assessment – Code of practice*

BS ISO 16739, *Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries*

3 Terms and definitions

For the purposes of this part of BS 8541, the terms and definitions given in BS 8541-1 and the following apply.

3.1 auditor
testing review body

3.2 declaration scheme
set of requirements for characterizing product or facility performance, prepared by an independent body other than the product manufacturer or supplier, and other than the purchaser or owner

NOTE 1 A declaration scheme might have legal or best practice status, which could influence how it is represented.

NOTE 2 BS EN 15804 refers to a Type III environmental declaration programme.

3.3 facility declaration
data associated to a facility such as a constructed asset, building or structure, provided or verified by a distinct independent declaration scheme to support evaluation and comparisons

3.4 declarer
provider of the declaration, typically the manufacturer or supplier, but can be a library or scheme provider

NOTE BS EN ISO 14025 and BS EN 15804 refer to "programme operator".

3.5 product declaration
data related to a product provided or verified by a distinct independent declaration scheme to support specification and selection

3.6 tester
testing body

NOTE Verification is considered as a type of testing in the context of this standard.

3.7 verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[SOURCE: BS EN ISO 9000:2005]

4 Declaration processes

4.1 Preparation and publication

The product manufacturer or other library supplier should provide product data, including any current product declarations, in a form that can be used by BIM processes to support the following purposes:

a) reviewing and confirming declarations by providing the references to definitive resources;

b) specifying and selecting conformant products or facilities by structuring the performance data in a checkable format;

c) comparing alternative compliant product and facilities by structuring the performance data in a sortable format; and

d) analysing and predicting performance by providing clear explanation of the scenarios assumed alongside the values.

4.2 Use

Use should be determined by the declaration scheme objectives and limitations. Confirmation of the declaration information should be undertaken when used for reporting, for validation and for comparison.

Declarations of minimum or maximum performance should not be compared with typical performance and should only be used with caution in simulations and analysis.

Schemes may use different bases for the assessment, and so values provided under different schemes should not be compared.

EXAMPLE: What is measured by BS EN 15804 as global warming potential (GWP) is not the same as what is measured as climate change by BRE Environmental Profiles 2008 [1] nor the same as what ICE measures as embodied carbon (which is reported separately for ECO_2 and ECO_2Eq).

5 Principles for the exchange of declarations

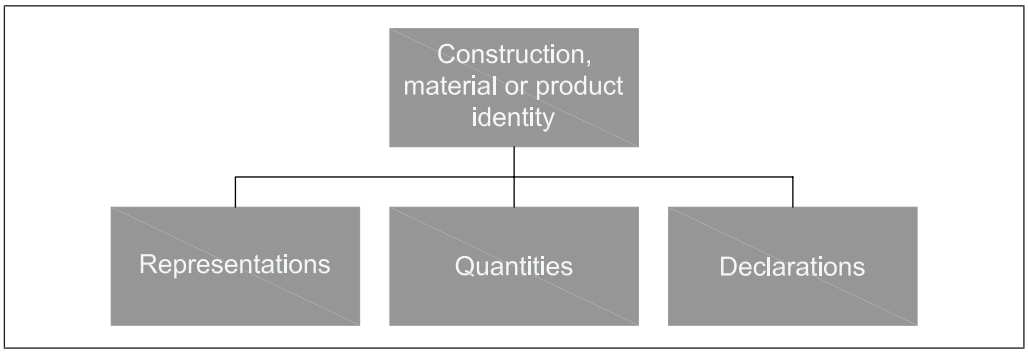
5.1 Construction objects

Any declaration attached to a construction library object should be based on the associated quantity measures of the product or facility (see Figure 2).

NOTE 1 See BS 8541 Parts 1 to 4 for more information on the exchange of product data.

Facility information should follow similar standards particularly in relation to naming, classification and measurement

Figure 2 **Construction object**



The quantity should be provided as mass and/or volume, or on a unit product, or in some cases areas or thicknesses (see Table 1 and Table 2).

NOTE 2 For more information see BS 8541-3.

Table 1 **Quantity set definition**

Quantity set name	BaseQuantities
Applicable entities	IfcMaterial, IfcTypeProduct, IfcBuilding, IfcProxy
Description	Base Quantities

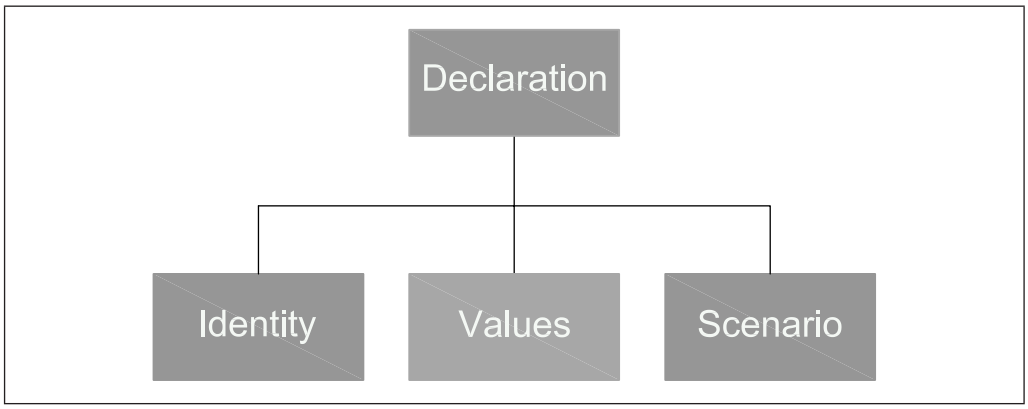
Table 2 **Quantity definitions**

Quantity name	Measure	Example value and unit		Description
GrossWeight	mass	*2 400*	*kg*	Characteristic mass
GrossVolume	volume	*1*	*m^3*	Characteristic volume

NOTE 3 In Table 2 to Table 7, example values and units in italic are informative.

Declarations should be exchanged as a property set with properties covering identification, declared values and their scenario (see Figure 3).

Figure 3 **Declaration property set**



Property set names and property names should be in CamelCase without spaces.

NOTE 4 See BS 8541-4.

NOTE 5 See Annex A for examples.

5.2 Property set

A declaration should be transmitted as a grouped set of properties so that the performance values provided have sufficient context to enable appropriate use.

NOTE 1 The use of property sets separates the declaration from other values and allows multiple declarations to be transmitted within one construction library object.

The property set should be named so as to identify the declaration scheme, the product or facility type and the applicable locale (see Table 3).

Table 3 **Property set naming**

Aspect	Measure	Example	Description
Scheme	text	*scheme1*	The declaration scheme should be identified by an abbreviation or acronym.
Sub-scheme	text	*aspect1* *Declaration*	The sub-scheme or product type should be specified. "Declaration" should be appended.
Locale	text	*locale1*	Any applicable locale may be identified by a country or regional code (optional).
Property set name	text	*scheme1_aspect1Declaration_locale1*	The preceding aspects should be concatenated using an underscore.

The property set should be described by expanding the name with any qualifications required (see Table 4).

NOTE 2 Recipient applications might not preserve the description.

Table 4 **Description**

Aspect	Measure	Example	Description
Scheme	text	*scheme1*	The declaration scheme should be identified.
Sub-scheme	text	*aspect1*	The sub-scheme or product type should be specified.
Locale	text	*locale1*	Any applicable locale may be identified (optional).
Property set description	text	*aspect1_declaration_according to_locale1_scheme1*	No unusual punctuation should be used.

5.3 Identification properties

5.3.1 General

Properties should be provided to support identification of the declaration and confirmation of the data provided. Indications of the level of attestation should also be provided (see Table 5).

NOTE See BS 8541-1 for the identification of the product itself and the manufacturer.

The declaration type, tester type and auditor type should indicate the level of attestation and/or type of verification and what standard was used for testing and/or verification.

Table 5 **Properties used for product declaration identification**

Property name	Measure	Example value and unit	Description
Scheme	text, as recommended in **5.2**	*scheme1*	The scheme should be identified. (Required)
Sub-scheme	text, as recommended in **5.2**	*aspect1*	The sub-scheme or product type should be identified (optional).
Identifier	text	*1234-1234-1234-1234*	The unique identifier of the product declaration, typically a code or filename. This may be the product identification. (Required)
Applicability	text, list	*external, openings*	List of any applicable criteria. These are cumulative criteria that are applied serially. (Optional)
Selection	text, list	windows, doors	List of any selective criteria. These are alternative criteria that are applied in parallel. (Optional)
Exception	text, list	*on escape route*	List of any relevant exception criteria. (Optional)
Confirmation	text	*www.scheme.com/declarations*	Method of confirming the information provided, typically a URI [A)] or email or code. (Required)
Attestation type	enumeration	*un-attested, independent*	The overall degree of attestation associated to this declaration, depending on who declared, tested and audited the value(s) provided. The enumeration list may be specific to the scheme. (Optional)
Declaration type	enumeration	*self-declared, independent*	The degree of attestation associated to this declaration, depending on who provided the value(s). The enumeration list may be specific to the scheme. (Optional)
Testing type	enumeration	*self-tested, independent, untested*	The degree of attestation associated to this declaration, depending on who tested the product value(s). The enumeration list may be specific to the scheme. (Optional)
Auditing type	enumeration	*self-audited, independent, unaudited*	The degree of attestation associated to this declaration, depending on who audited the value(s). The enumeration list may be specific to the scheme. (Optional)
Declarer	text		Identifier of the providing organization, typically a URI [A)] or email or code. (Optional)
Tester	text		Identifier of the testing organization, typically a URI [A)] or email or code. (Optional)
Auditor	text		Identifier of the auditing organization, typically a URI [A)] or email or code (Optional)

[A)] Unique resource identifier

5.3.2 Value properties

Properties should convey the declared values (see Table 6). If a declared value includes both a value and a grade, these should be declared as separate properties. Properties and values should only be provided appropriate to the type of the product or facility.

Any values declared should be based on the same quantity or functional unit as all other properties of the product or facility.

*NOTE 1 See BS 8541-3 and **5.1**.*

Property names should be in CamelCase with no unusual punctuation. Units and qualifications should not be included.

Property names should match the scheme definition, unless already defined in IFC (BS ISO 16739).

EXAMPLE: "Acoustic Performance (dB)" property named as "AcousticPerformance".

Absolute measures should be used in preference to relative ratios, proportion or percentages, with a corresponding measurement given for the product.

EXAMPLE: "RecycledContent" is better exchanged as a mass with the mass of the product also being given.

Property names reflecting a "no lower than" value should include the prefix minimum. Property names reflecting a "no higher than" value should include the prefix "Maximum".

EXAMPLE: "Acoustic Performance" property representing a worse case performance named as "MinimumAcousticPerformance".

Property names with enumerated values should include the suffix "Grade".

EXAMPLE: "Acoustic Performance" rating property named as "AcousticPerformanceGrade".

Property descriptions should match the scheme definition, and should also include any qualifications or recommended units.

EXAMPLE: "Acoustic Performance (dB)" property described as "Acoustic Performance (dB)".

If the property is a coded grade or enumeration then the description should also indicate the more beneficial grade.

EXAMPLE: "Acoustic Performance Grade" property described as "Acoustic Performance Grade (1 = minimal, 5 = best)".

NOTE 2 Recipient applications might not preserve the description.

Table 6 **Declaration values for a property [Property]**

Property name	Measure	Example value and unit		Description
[Property]	logical	*unknown*		Compliance property should support values "true", "false" and "unknown".
	enumeration	*unknown*		Enumerated property should support values allowed values plus "unknown".
	measure	*25*	*Pa*	Numeric property such as pressure or length.
	measure	*20, ,30*	*Pa*	The lower and upper bound for a numeric range, such as linear or pressure, should be given. An intermediate modal value may be given.
[Property] Grade	enumeration			Graded property (levels of performance) should support expected values plus "unknown".

NOTE 3 Some declaration schemes expect terms other than "unknown", such as "NPD" ("no performance declared").

5.3.3 Scenario properties

Properties should be provided to convey the scenario or process assumed in preparing the declared values (see Table 7).

Table 7 **Scenario properties**

Property name	Measure	Example value and unit		Description
Process	text	*Transport by road from factory or port*		Description of the evaluated process and scenario
Life cycle category	enumeration	*A4*	A, A1 to 3, A1, A2, A3, A4, A5, A5.1, B, B1, B2, B3, B4, B5, B5.1, B5.2, B6, B7, C, C1, C2, C3, C4, (D)	Enumerated classification following BS EN 15804 may be provided
Life cycle phase	enumeration	*transport*	raw material supply, transport, manufacturing, construction, use, maintenance, repair, replacement, refurbishment, deconstruction, waste processing, disposal, reuse, recovery, recycling	Enumerated name of the life cycle process may be provided
Inland transport distance	linear	45	km	Distance from factory to site
Capacity utilization	ratio	38	%	Capacity utilization (including empty returns)
Volume capacity utilization factor	ratio	1.0		Volume capacity utilization factor (factor =1 or <1 or ≥1 for compressed or nested packaged products)

NOTE BS EN 15804 refers to "life cycle information module" and "life cycle stage".

Costs and other economic indicators should be provided with the context of a specific date and a specific region (see Table 8).

Table 8 **Regional (for facilities) and date basis**

Property name	Measure	Example value and unit		Description
Cost date source	text	*source1*		Name of date data series should be provided
Cost date basis	date or text	*basis1*		Selected date may be provided
Cost date factor	ratio	*259*	*percent*	Factor should be provided
Cost region source	text	*source2*		Name of region data series should be provided
Cost region basis	text	*basis2*		Selected location may be provided
Cost region factor	ratio	*117*	*percent*	Factor should be provided

5.3.4 Conformity

Product declaration information should not be included without providing the scheme identifier (see Table 9a).

NOTE Some product declaration schemes apply only to manufactured products (excluding on-site fabricated products) or only to marketed products (excluding bespoke products).

Table 9a **Expected declaration properties within construction library objects**

	Scheme identification (5.2)	Scheme values (5.3.2)	Scheme scenario (5.3.3)
Template objects	required	no	optional
Generic objects	required	optional	optional
Product objects	required	required	optional

The library object should be tested against BS 8541-1, BS 8541-2, BS 8541-3 and BS 8541-4.

Facility declaration information should not be included without providing a scheme identifier (see Table 9b).

Table 9b **Expected declaration properties for facilities**

	Scheme identification (5.2)	Scheme values (5.3.2)	Scheme scenario (5.3.3)
Facility models	required	required	optional

Annex A (informative) Example product declaration schemes

A.1 General

The information given in **A.2** to **A.8** illustrates the application of Clause **5**.

This is not necessarily a complete representation of all aspects of each example scheme. Reference ought to be made to the latest published version of the scheme.

A.2 Environmental product declarations (EPDs) (BS EN 15804)

There are 24 environmental indicators used in the BS EN 15804 and BS EN 15978 standards. Table A.1 and Table A.2 summarize their possible representation.

EPDs might relate to an object considered historically, such as "Embodied" CO_2 equivalent, while others relate to an object projected forward a number of years into the future, such as for "Operation".

BS EN 15804 refers to the declaration scheme as "programme" and the declarer as the "programme operator".

Comparison of the environmental performance of construction products using the information provided in an EPD conforming to BS EN 15804 needs to be based on the product's use in and its impacts on the building, and consider the complete life cycle, as described in BS EN 15804:2012+A1:2013, **5.3**. EPDs not based on BS EN 15804 ought not to be used for comparison unless they share the same product category rules.

The level of attestation may relate to the information required for the verification of constancy of performance as described in the text on verification of an EPD in BS EN ISO 14025 and BS EN 15804.

Each declaration provides the indicator values for one scenario (information module).

NOTE An example transport scenario is given in Table A.3.

Property names reflect both IFC (BS ISO 16739) and BS EN 15804.

Table A.1 **Environmental product declaration property set definition**

Property set name	EPD_Declaration_EU
Applicable entities	IfcMaterial, IfcTypeProduct
Description	Declaration from BS EN 15804 EPD matrix

Table A.2 **Environmental property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*EPD*		BS EN 15804 EPD matrix
Sub-scheme	text	*NPCR 010 rev1 Building boards 2013 [2]*		Relevant product category rules
Identifier	text	*NEPD NO: 999E*		Identifier for the product declaration, typically a code or filename
Applicability	text, list	*interiors, all building types, normal fire, normal structure, heavier use*		Intended use
Selection		*A1-5, B1, C2, C4*		
Exception	text, list	*B2, B3, B4, B5, C1, C3, B6, B7*		Excluded use
Testing	text	*ISO 14025 $8.1.3*		Verification type
Tester	text	*an.other@email.com*		Independent external verifier as a named individual
Attestation type	enumeration	*Independent declaration*		
Declaration type	enumeration	*Independent declaration*		To BS EN 15804
Testing type	enumeration	*Independent declaration*		Verified to BS EN ISO 14025 and BS EN 15804
Auditing type	enumeration	*Not Audited*		
Confirmation	text	*www.acme_approvals.co.uk/999E*		Publically accessible resource where EPD can be checked
Process	text	Use of crane for replacement of sealants		
Life cycle stage	enumeration	*replacement*	production, transport, implementation, utilization, end of life	Enumerated name of the life cycle process.
Life cycle category	enumeration	*B3*	A, A1 to 3, A1, A2, A3, A4, A5, A5.1, B, B1, B2, B3, B4, B5, B5.1, B5.2, B6, B7, C, C1, C2, C3, C4, (D)	Enumerated classification following BS EN 15804 may be provided
Service life duration	duration	*9*	*Years*	See BS ISO 15686
Method of measurement	text	*BS EN 15804*		BS EN 15804
Energy carrier type	enumeration, list	*electricity*	*electricity* *gas* *other* *not known*	If more energy carriers are used then they can be listed separately

Table A.2 **Environmental property definitions** *(continued)*

Property name	**Measure**	**Example value and unit**		**Description**
Energy quantity	energy	*3*	*kWh*	
Material replaced	text, list	*Silicone sealant*		If more than one material is replaced then they can be listed
Quantity replaced	mass	*0.4*	*kg*	
Waste destination	enumeration	*landfill*	*landfill* *other* *not known*	
Lead-in time	duration	*5*	*year*	Lead-in time before process repetition
Duration	duration	*1*	*year*	Process duration
Lead-out time	duration	*3*	*year*	Lead out time after process repetition
Property name	**Measure**	***Example value and unit***		**Environmental Impact indicators**
Abiotic depletion potential non-fossil resources	mass	*3.13*	*kg (EN 15804)*	Abiotic depletion potential for non-fossil resources
Abiotic depletion potential fossil resources	mass	*3.13*	*kg (EN 15804)*	Abiotic depletion potential for fossil resources
Climate change	mass	*3.13*	*kg (EN 15804)*	Global warming potential in equivalent CO_2
Acidification potential	mass	*3.13*	*kg (EN 15804)*	Acidification potential for soil and water calculated in kg SO_2 equivalent
Ozone depletion potential	mass	*3.13*	*kg (EN 15804)*	Depletion potential of the stratospheric ozone layer calculated in kg CFC 11 equivalent
Eutrophication potential	mass	*3.13*	*kg (EN 15804)*	Eutrophication potential, calculated in kg PO_4^{3-} equivalent
Photochemical ozone formation	mass	*3.13*	*kg (EN 15804)*	Photochemical ozone creation: Formation potential of tropospheric ozone calculated in mass of ethene equivalent
Property name	**Measure**	***Example value and unit***		**Resource use indicators**
Renewable primary energy excluding renewable primary energy resources used as raw materials	energy	*540*	*MJ (EN 15804)*	Renewable primary energy excluding renewable primary energy resources used as raw materials (used for producing energy)
Renewable primary energy resources used as raw materials	energy	*540*	*MJ (EN 15804)*	Renewable primary energy resources used as raw materials (used as feedstock)

Table A.2 **Environmental property definitions** *(continued)*

Property name	**Measure**	**Example value and unit**		**Description**
Renewable primary energy resources total	energy	*540*	*MJ (EN 15804)*	Renewable primary energy resources total (primary energy and primary energy resources used as raw materials)
Non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	energy	*540*	*MJ (EN 15804)*	Non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (used for producing energy)
Non-renewable primary energy resources used as raw materials	energy	*540*	*MJ (EN 15804)*	Non-renewable primary energy resources used as raw materials (used as feedstock)
Non-renewable primary energy resources total	energy	*540*	*MJ (EN 15804)*	Non-renewable primary energy resources total (primary energy and primary energy resources used as raw materials)
Use of secondary material	energy	*540*	*MJ(EN 15804)*	Use of secondary material
Use of renewable secondary fuels	energy	*540*	*MJ (EN 15804)*	Use of renewable secondary fuels
Use of non-renewable secondary fuels	energy	*540*	*MJ (EN 15804)*	Use of non-renewable secondary fuels
Use of net fresh water	volume	*525*	*m^3 (EN 15804)*	Use of net fresh water
Property Name	**Measure**	***Example value and unit***		**Waste output indicators**
Hazardous waste disposed	mass	*0.0023*	*kg (EN 15804)*	Hazardous waste disposed
Inert waste disposed	mass	*23*	*kg (EN 15804)*	Non-hazardous waste disposed
Radioactive waste disposed	mass	*0.023*	*mg (EN 15804)*	Radioactive waste disposed
Property Name	**Measure**	***Example value and unit***		**Output indicators**
Components for reuse	mass	*130*	*kg (EN 15804)*	Components exported from the product system for reuse
Materials for recycling	mass	*20*	*kg (EN 15804)*	Materials exported from the product system for recycling
Materials for energy recovery	mass	*10*	*kg (EN 15804)*	Materials exported from the product system for energy recovery
Exported energy electricity	energy	*230*	*MJ (EN 15804)*	Energy exported from the product system as electricity
Exported energy heat	energy	*300*	*MJ (EN 15804)*	Energy exported from the product system as heat

Table A.3 **Example transport scenario properties**

Property name	**Measure**	**Example value and unit**		**Description**
Process	text	*Transportation from the production gate to the construction site using* truck; *diesel driven, Euro 3; 7.5 t – 12 t gross weight/ 5 t payload capacity 25.4 L per 100 km*		Description of the evaluated process and scenario
Life cycle category	enumeration	*A4*		Enumerated classification following BS EN 15804
Life cycle stage	enumeration	*transport*		Enumerated name of the life cycle process
Inland transport distance	linear	45	km	Distance from factory to site
Capacity utilization	ratio	38	%	Capacity utilization (including empty returns)
Volume capacity utilization factor	ratio	1.0	n/a	Volume capacity utilization factor (factor =1 or <1 or ≥1 for compressed or nested packaged products)

A.3 BRE Environmental profiles data (2008 Methodology)

The BRE Green Guide [3] and IMPACT tools [4] use environmental data for products and materials in assessing embodied and in-use impacts. The environmental data are produced using product category rules (PCRs) to BS EN ISO 14025 and BS ISO 21930 known as "environmental profiles" published by BRE [1]. The data consist of 13 environmental indicators and a weighted "Ecopoint" described in the PCR. Environmental profiles data can be provided for cradle-to-gate or cradle-to-site for a material or product, or cradle-to-grave for a product in a construction, as described in the PCR. Table A.4 and Table A.5 summarize a possible representation.

NOTE BRE also run an EPD Programme to BS EN 15804, and are planning to use data evaluated to BS EN 15804 within future versions of the Green Guide [3] and IMPACT [4]. It is therefore important to check which PCR is used for IMPACT or Green Guide data.

Table A.4 **BRE property set definition**

Property set name	BRE_EnvironmentalProfilesDeclaration_UK
Applicable entities	IfcMaterial, IfcTypeProduct
Description	Declaration from BRE Environmental Profiles database

Table A.5 **BRE property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*BRE Environmental Profiles [1]*		*BRE data used in BRE Green Guide [3] and IMPACT tools [4]*
Sub-scheme	text	*BRE Global Methodology for Environmental Profiles of Construction Products [1]*		
Identifier	text	*2312312*		Identifier for the product declaration, typically a code or filename
Applicability	text, list	*Concrete,*		Intended use
Exception	text, list	*Marine*		Excluded use
Confirmation	text, list	*n/a*		Publically accessible resource
Attestation type	enumeration	*Independent*		
Declaration type	enumeration	*Independent*		
Testing type	enumeration	*Not tested*		
Auditing type	enumeration	*Not audited*		
Method of measurement	text	*BRE Environmental Profiles 2008 [1]*		
Life cycle phase	enumeration	*Cradle-to-gate*		Life cycle stages for which the data are relevant
Life cycle classification	enumeration	A*1-3*		
Climate change	mass	*568.2*	*kg (BRE 2008)*	Climate change/Global warming potential: Greenhouse gases emitted reported in CO_2 equivalent (100 yr) (BRE Environmental Profiles 2008 [1])
Water extraction	volume	*32.4*	*m^3 (BRE 2008)*	Water extraction reported by volume (BRE Environmental Profiles 2008 [1])
Mineral resource extraction	mass	*2 482.2*	*kg (BRE 2008)*	Mineral resource extraction reported by mass minerals extracted (BRE Environmental Profiles 2008 [1])
Stratospheric ozone layer destruction	mass	*0.0238*	*kg (BRE 2008)*	Gases depleting the stratospheric ozone layer reported in CFC-11 equivalent mass (BRE Environmental Profiles 2008 [1])
Human toxicity	mass	*2 285.8*	*kg (BRE 2008)*	Human toxicity reported by mass 1.4 dichlorobenzene (1.4-DB) equivalent (BRE Environmental Profiles 2008 [1])

Table A.5 **BRE property definitions** *(continued)*

Property name	Measure	Example value and unit		Description
Ecotoxicity to freshwater	mass	*153.3*	*kg (BRE 2008)*	Ecotoxicity to freshwater reported by mass 1.4-DB equivalent (BRE Environmental Profiles 2008 [1])
Radioactive waste	mass	*2.88E-06*	*mm^3 (BRE 2008)*	Nuclear waste – higher level radioactive waste generated, reported by volume (BRE Environmental Profiles 2008 [1])
Ecotoxicity to land	mass	*15.3*	*kg (BRE 2008)*	Ecotoxicity to land reported by mass in 1.4-DB equivalent. (BRE Environmental Profiles 2008 [1])
Waste disposal	mass	*487.6*	*t (BRE 2008)*	Waste disposal reported as mass solid waste (BRE Environmental Profiles 2008 [1])
Fossil fuel depletion	mass	*83 155.8*	*kg (BRE 2008)*	Fossil fuel depletion reported as mass of oil equivalent (BRE Environmental Profiles 2008 [1])
Eutrophication	mass	*10.7*	*kg (BRE 2008)*	Eutrophication reported in equivalent mass phosphate (PO_4^{3-}) (BRE Environmental Profiles 2008 [1])
Photochemical ozone formation	mass	*3.13*	*kg (BRE 2008)*	Photochemical ozone creation reported as mass ethylene/ethene equivalent (BRE Environmental Profiles 2008 [1])
Atmospheric acidification	mass	*3.13*	*kg (BRE 2008)*	Acidification reported as mass of SO_2 equivalent (BRE Environmental Profiles 2008 [1])
Ecopoints	ratio	*1 300*	*Ecopoints (BRE 2008)*	Quantity of BRE Ecopoints. (BRE Environmental Profiles 2008 [1])

A.4 BSRIA – University of Bath carbon data

The Inventory of Carbon and Energy (ICE) [5] includes ranges of likely values for primary energy and embodied CO_2 equivalent of generic materials. Table A.6 and Table A.7 summarize a possible representation.

Table A.6 **Carbon data property set definition**

Property Set Name	ICE_Declaration_UK
Applicable Entities	IfcMaterial, IfcTypeProduct
Description	Declaration from ICE data

Table A.7 **Carbon data property definitions**

Property name	**Measure**	**Example value and unit**		**Description**
Scheme	text	*ICE*		Inventory of Carbon and Energy [5]
Sub-scheme	text	*V2*		
Identifier	text	*Concrete – General*		Identifier for the product declaration, typically a code or filename
Applicability	text, list	*Concrete,*		Intended use
Exception	text, list	*special mix, prefabricated element*		Excluded use
Confirmation	text, list	*http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html*		Publically accessible resource
Attestation type	enumeration	*Independent declaration*		
Declaration type	enumeration	*Independent declaration*		
Testing type	enumeration	*Not tested*		
Auditing type	enumeration	*Not audited*		
Method of measurement	text	*ICE*		ICE
Life cycle phase	enumeration	*Cradle-to-gate*		
Total primary energy consumption	energy, list	*2 280, , 3 600*	*MJ (ICE)*	Minimum, indicative, and maximum ICE embodied energy
Climate change	mass, list	*313, ,750*	*kg (ICE)*	Minimum, indicative, and maximum ICE embodied carbon and maximum value covering all greenhouse gases measured in mass of CO_2 equivalent
Embodied carbon	mass, list	*300*	*kg (ICE)*	Indicative ICE embodied carbon covering only carbon dioxide measured in mass of CO_2

The associated thermal properties might be transmitted as a standard material property set. Density is not transmitted, as mass and volume are documented as base quantities. Table A.8 and Table A.9 summarize a possible representation.

Table A.8 **Thermal property set definition**

Property set name	Pset_MaterialThermal
Applicable entities	IfcMaterial
Description	A set of thermal material properties

NOTE See BS ISO 16739 for the full definition of Pset_MaterialThermal.

Table A.9 **Thermal property definitions**

Property name	Measure	Example value and unit		Description
Specific heat capacity	specific heat capacity	*840*	*J/kg/degK*	Defines the specific heat of the material: heat energy absorbed per temperature unit
Thermal conductivity	thermal conductivity	*1.8*	*W/m/degK*	The rate at which thermal energy is transmitted through the material

A.5 Construction Products Regulation [6] (CPR) and CE marking

The construction property set incorporates the declaration of performance (DOP), except the identification of the manufacturer and product, and the quantification (see BS 8541-1 and BS 8541-3). Table A.10 and Table A.11 summarize a possible representation.

The level of attestation may relate to the information required for the verification of constancy of performance as described in the Construction Products Regulation [6].

Table A.10 **Construction property Set definition**

Property set name	CPR_WindowsDeclaration_UK
Applicable entities	IfcWindowType
Description	Declaration for UK Construction Products Regulation [6] for windows not on an escape route

Table A.11 **Construction property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*CPR*		Construction Products Regulation [6]
Sub-scheme	text	*Window*		BS EN 14351-1:2006+A1:2010, Annex ZA
Identifier	text	*111-100*		Identifier for the product declaration, typically a code or filename
Applicability	text, list	*Window*		Intended use
Exception	text, list	*on an escape route*		Excluded use
Confirmation	text	*www.acme.co.uk/DoP/111-100.pdf*		Publically accessible resource
Test	text	*System 2+, Notified factory production control certification body No. 5678 performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control*		Test evidence to BS EN ISO 10077-1 and BS EN ISO 10077-2 to be completed or verified by an accredited Notified Body
Attestation type	enumeration	*3*	*4, 3, 2+, 1, 1+*	According to CEN Guidance TF N 530 [7]: 4: Initial testing; 3: Independent initial testing; 2+: Initial testing with independent continuous surveillance; 1: Independent initial testing and continuous surveillance; 1+: Independent audit testing
Tester	text	*5 678*		
Thermal transmittance	thermal transmittance	*1.6*	*W/m^2.K*	Thermal transmittance (in the UK it is a requirement of the Building Regulations [8], [9] and [10])
Maximum load-bearing capacity of safety devices	force	*40*	*N*	Load-bearing capacity of safety devices
Dangerous substances	text, list			Dangerous substances (blank if none)
Air permeability	real	*600*	*m^2/hr*	Air permeability

Table A.11 **Construction property definitions** *(continued)*

Property name	Measure	Example value and unit		Description
Air permeability grade	enumeration	*3*		Air permeability grade 0, 1, 2, 3, NPD
Watertightness	pressure	*200*	*Pa*	Water tightness
Resistance to wind load	force	*40*	*N*	Resistance to wind load
Acoustic performance	real	*32*	*dB*	Acoustic performance
Radiation properties grade	text	*NPD*		Radiation properties grade
Ability to release grade	logical	*True*		Ability to release grade

A.6 WRAP construction resource efficiency

A.6.1 General

WRAP (Waste and Resources Action Programme) [11] advocates a range of metrics that can be used to quantify resource efficiency in construction, including materials, waste, water and energy, all contributing to reducing carbon emissions for any type of construction product and facility. Supplementary cost and environmental information ought to be included in separate property sets.

A.6.2 WRAP Product declaration

Table A.12 and Table A.13 summarize a possible representation.

Table A.12 **WRAP property set definition**

Property set name	WRAP_ProductDeclaration_UK
Applicable entities	IfcMaterial, IfcTypeProduct
Description	UK WRAP Product Resource Efficiency Declaration

Table A.13 **WRAP property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*WRAP*		WRAP (Waste and Resources Action Programme)
Sub-scheme	text	*Construction Products*		
Identifier	text	*WRAP-CP-Dataset_v8*		Identifier for the product declaration, typically a code or filename
Applicability	text, list	*concrete, foundations, Strength C25 or lower, newbuild*		Intended use
Exception	text, list	*Housing*		Excluded use
Confirmation	text	*www.wrap.org.uk/builtenvironment*		Publically accessible resource
Recycled content	mass, list	*288, 360, 408*	*kg*	Indicative lower, typical and upper values for recycled content
Wastage	mass, list	*120, 60, 0*	*kg*	Indicative lower, typical and upper values for wastage on construction sites (WRAP)

Indicative economic impacts can be transmitted separately. Table A.14 and Table A.15 summarize a possible representation.

Table A.14 **WRAP property set definition – indicative economic impacts**

Property set name	WRAP_EconomicImpacts_UK
Applicable entities	IfcMaterial
Description	Declaration of economic impacts from WRAP

Table A.15 **WRAP property definitions – indicative economic impacts**

Property name	Measure	Example value and unit		Description
Method of measurement	real	*WRAP*		WRAP (Waste and Resources Action Programme)
Life cycle phase	enumeration	*Cradle-to-site*		Life cycle phase as defined in BS EN 15978
Cost	currency	*115*	*gbp*	Total (LPM) cost (WRAP)
Material cost	currency	70	*gbp*	Material cost (WRAP)
Labour cost	currency	*45*	*gbp*	Labour cost (WRAP) (optional)
Cost date source	text	*BCIS All In TPI*		Name of date data
Cost date basis	date or text	*1Q09*		Selected date
Cost date factor	ratio	*259*	*percent*	Factor
Cost region source	text	*BCIS All In LPI*		Name of region data series
Cost region basis	text	*South East*		Selected location
Cost region factor	ratio	*117*	*percent*	Factor

Indicative environmental impacts can be transmitted separately. Table A.16 and Table A.17 summarize a possible representation.

Table A.16 **WRAP property set definition – environmental impacts**

Property set name	WRAP_EnvironmentalImpacts_UK
Applicable entities	IfcMaterial
Description	Declaration of WRAP environmental impacts

Table A.17 **WRAP property definitions – environmental impacts**

Property name	Measure	Example value and unit	Description
Method of measurement	text	*WRAP*	Waste and Resources Action Programme
Life cycle phase	text	*Cradle-to-site*	
Climate change	mass	*257 kg*	Greenhouse gasses emitted calculated in equivalent CO_2 mass

A.6.3 WRAP facility declaration

The facility name, address, measures and classification will be associated to the facility separately. Table A.18 and Table A.19 summarize a possible representation.

Table A.18 **WRAP property set definition**

Property set name	WRAP_FacilityResourceEfficiency_UK
Applicable entities	IfcBuilding, IfcProxy
Description	Declaration of resource use and resource efficiency for a facility

Table A.19 **WRAP property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*WRAP*		WRAP (www.wrap.org.uk)
Sub-scheme	text	*Project resource efficiency*		
Applicability	text, list	*Structure, fabric, MEP*		Elements included in the project, applied serially (optional)
Selection	text, list	*New west wing, East wing refurbishment*		Elements included in the project, applied in parallel (optional)
Exception	text, list	*External works, landscaping*		List of any elements not included in the project (optional)
Life cycle category	enumeration, list	*A1-5, B5*		Include all stages relevant to the project data (BS EN 15978)
Cost date basis	date, list	*Jan14, Sep14*		Start and end of the date range to which to the data applies
Construction cost	currency	*15 000 000*	*gbp*	Project/construction cost (WRAP)
Site staff	people	*320*	*number*	Average people on site during project (optional)
Declarer	text	*Green Construction Ltd*		Declarer of the data
Construction waste hazardous	mass	*0*	*t*	Quantity of hazardous construction waste
Construction waste non-hazardous	mass	*2685*	*t*	Quantity of non-hazardous construction waste
Demolition waste hazardous	mass	*3*	*t*	Quantity of hazardous demolition waste
Demolition waste non-hazardous	mass	*18*	*t*	Quantity of non-hazardous demolition waste
Excavation waste hazardous	mass	*0*	*t*	Quantity of hazardous excavation waste
Excavation waste non-hazardous	mass	*0*	*t*	Quantity of non-hazardous excavation waste
Waste to landfill	mass	*12*	*t*	Total quantity of waste sent to landfill/incineration without energy recovery for all works undertaken
Materials used	mass		*t*	Total quantity of materials purchased for use in the project (optional)
Recycled content	currency	*320000*	*gbp*	Recycled content by value of materials used in the project (WRAP)
Certified timber	volume	*95*	m^3	Timber used from certified sustainable sources (e.g. FSC, PEFC, Grown in Britain)

Table A.19 **WRAP property definitions** *(continued)*

Property name	Measure	Example value and unit		Description
Water consumption site	volume	*1 120*	m^3	Quantity of abstracted and mains water used in all site activities
Embodied water	volume		m^3	Total quantity of water embodied in the project, including in the materials (e.g. data from EPDs) and used on site (optional)
Energy consumption site	energy	*1 675 544*	*kWh*	Quantity of fuel/energy used in all site activities
Renewable energy consumption site	energy	*0*	*kWh*	Quantity of fuel/energy from renewable sources used in all site activities
Carbon scope 1	carbon emission	*1 011*	*t*	Direct construction CO_2e emissions (encord)
Carbon scope 2	carbon emission	*2 750*	*t*	Indirect construction CO_2e emissions (encord)
Carbon scope 3	carbon emission	*2 887*	*t*	Other construction CO_2e emissions (encord)

NOTE Carbon scopes are as defined in encord's Construction CO_2e Measurement Protocol [12].

A.7 Display energy certificate (DEC)

Display energy certificate (DEC) is a required declaration for display in some public buildings (see *A guide to display energy certificates and advisory reports for public buildings* [13]). This subclause shows how such information might be exchanged as part of a BIM. Unlike product declarations, a facility declaration is applicable only to the one occurrence. Table A.20 and Table A.21 summarize a possible representation.

The facility name, address, measures and classification will be associated to the facility separately.

Table A.20 **DEC property set definition**

Property set name	DEC_BuildingDeclaration_UK
Applicable entities	IfcBuilding, IfcProxy
Description	Display Energy Certificate

Table A.21 **DEC property definitions**

Property name	Measure	Example value and unit		Description
Scheme	text	*DEC*		Display energy certificate
Sub-scheme	text	*SI2007:991 as amended*		
Identifier	text	*1234-1234-1234-1234*		Identifier for the product declaration, typically a code or filename.
Confirmation	text	*http://www.dec.gov.uk/1234-1234-1234-1234*		Publically accessible resource
Declarer	text	*ABC12345*		Declarer
Tester	text	*ABC Accreditation Ltd*		Tester
Main heating fuel	enumeration	*gas*	*gas, electricity*	Main heating fuel
Building environment	enumeration	*air conditioned*		Building environment
Total useful floor area	area	*2 927*	m^2	Total useful floor area (TUFA)
Asset rating	ratio	*92*	*percent*	Original or predicted asset rating (lower is better)
Energy performance operational rating	ratio	*153, 133, 108*	*percent*	Energy performance operational rating. Three years performance (lower is better)
Energy performance operational rating grade	enumeration	*E*	*A, B, C, D, E, F, G*	Energy performance operational rating grade. A is most energy efficient
Annual energy heating use	energy, list	*640, 450, 350*	*kWhr*	Annual energy heating use. Three years performance
Annual energy electrical use	energy, list	*700, 510, 380*	*kWhr*	Annual energy electrical use. Three years performance
Annual renewable heating	energy, list	*0, 0, 0*	*kWhr*	Annual renewable heating. Three years performance
Annual renewable electrical	energy, list	*40,40,70*	*kWhr*	Annual renewable electrical
Issue date	date	*2013-12-31*		Issue date
Nominated date	date	*2014-01-31*		Nominated date
Valid until	date	*2015-01-31*		Date valid until

A.8 Service life declaration

Service life declarations are defined in BS ISO 15686-4.

This includes the representation of different types of service life, environmental factors and uncertainty. Table A.22 summarizes a possible representation.

Table A.22 **Service life declaration definitions**

Property name	Measure	Example value and unit		Description
Service life type	enumeration	*reference*		The typical service life that is quoted for an artefact under reference operating conditions
Service life duration	duration	*18*	*years*	The length or duration of a service life

Annex B (informative) Product declaration attributes

B.1 COBie presentation attributes

Table B.1 gives information on COBie presentation attributes.

NOTE 1 Refer to BS 1192-4 for definitive information.

NOTE 2 Only selected columns shown from the Attributes sheet.

Table B.1 **Attribute**

Name	Sheet Name (lookup)	Row Name (lookup)	Value	Unit	ExtObject	Description	Allowed values
Scheme	Type	MyCompany MC999 Basin	CPR	text	CPR_WindowDeclaration_UK		
Sub-scheme	Type	MyCompany MC999 Basin	Window	text	CPR_WindowDeclaration_UK	BS EN 14351-1:2006 + A1:2010	
Air permeability	Type	MyCompany MC999 Basin	600	Pa	CPR_WindowDeclaration_UK	Air permeability	
Air permeability grade	Type	MyCompany MC999 Basin	3A	enumeration	CPR_WindowDeclaration_UK	Air permeability grade	1, 1A, 2, 2A, 3, 3A, NPD

B.2 IFC presentation

NOTE Refer to BS ISO 16739 for definitive information

#1000=IFCPROPERTYSET('08SmGoTLL969D6TGIRo_wT',#2002,'CPR_ WindowDeclaration_UK',

'CPR Window Declaration UK',(#1001,#1002,#1003,#1004);

#1001 = IFCPROPERTYSINGLEVALUE('Scheme', 'Product declaration scheme', IFCTEXT('CPR'), $);

#1002 = IFCPROPERTYSINGLEVALUE('SubScheme', 'Product declaration sub-scheme', IFCTEXT('Window'), $);

#1003 = IFCPROPERTYSINGLEVALUE('AirPermeability', 'Air Permeability', IFCPRESSUREMEASURE(600.0), #2001);

#1004 = IFCPROPERTYENUMERATEDVALUE('AirPermeabilityGrade ', Air permeability grade (1 is lowest)', IFCTEXT('3'), #1005);

#1005 = IFCPROPERTYENUMERATION('PEnum_ AirPermeabilityGrade ', IFCTEXT('1', '1A', '2', '2A', '3', '3A', 'NPD'), $);

B.3 IFCXML presentation

NOTE Refer to BS ISO 16739 for definitive information

```
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    <IfcOwnerHistory xsi:nil="true" ref="oh1"/>
  </OwnerHistory>
  <Name>CPR_WindowDeclaration_UK</Name>
  <Description>CPR_WindowDeclaration_UK</Description>
  <HasProperties>

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      <Name>Scheme</Name>
      <Description>Product declaration scheme </Description>
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      </NominalValue>
    </IfcPropertySingleValue>

    <IfcPropertySingleValue>
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      <Description>Product declaration sub-scheme</Description>
      <NominalValue>
        <IfcText>Window</Ifctext>
      </NominalValue>
    </IfcPropertySingleValue>

    <IfcPropertySingleValue>
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      <Description>Air Permeability</Description>
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      </NominalValue>
<Unit ref="Pa"/>
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    <IfcPropertyEnumeratedValue>
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      <Description>AirPermeability Grade (1=lowest) </Description>
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      </EnumerationValues>
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            <IfcText>NPD</IfcText>
          </EnumerationValues>
        </IfcPropertyEnumeration>
      </EnumerationReference>
    </IfcPropertyEnumeratedValue>
</HasProperties>
```

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2) In development.

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