BS 8541-1:2012

BSI Standards Publication

Library objects for architecture, engineering and construction

Part 1: Identification and classification – Code of practice

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Contents

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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 30 June 2012. 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 four parts as follows:

- Part 1 (this part), *Identification and classification*
- Part 2, *Recommended 2D symbols of building elements for use in building information modelling*
- Part 3, *Shape and measurement* [1)]
- Part 4, *Attributes for specification and assessment* [1)]

BS 1192 covers the management of collaborative design where the parties are well known to each other and typically have contractual relationships. This British Standard complements BS 1192 by covering the sharing of structured product data where the parties, such as a manufacturer and a designer or sub-contractor, might not have such relationships. In these circumstances, the use of common data standards ensures that information can be transmitted and used for a number of purposes.

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 of 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.

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) In preparation.

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0 Introduction

0.1 General

BS 8541-1, BS 8541-3[2)] and BS 8541-4[2)] document best practice for the development and application of library objects to support Building Information Modelling (BIM) based design, standardization, specification and construction processes.

BS 8541-3 and BS 8541-4 give additional recommendations for specific use-cases.

0.2 Work within the International Organization for Standardization (ISO)

ISO has adopted the IFC schema (ISO/PAS 16739), and the STEP (ISO 10303-21) and XML representation (ISO 10303-28, edition 2:2007) for the representation of building models. These standards being used internationally to transmit partial building models and construction object libraries to support a wide range of use-cases and applications. Using these international standards, the resources required to prepare and maintain proprietary formats can be reduced.

0.3 UK work

The use of the IFC standard can be supplemented with UK-based identification and classification (BS 8541-1 and its recommended classifications), and UK specific quantification [BS 8541-3[2)]] and specification [BS 8541-4[2)]].

0.4 COBie

COBie examples are provided in Annex A.

COBie is formal schema that helps the sharing of structured information about new and existing facilities and their constituent products, see COBie standard [1], defined as the FM Handover MVD and documented in the COBie responsibility matrix [2]. It can be used to document both buildings and infrastructure assets and can be transmitted using a spreadsheet.

COBie is required as part of the UK Government BIM strategy.

0.5 Core maturity model

This British Standard assists the implementation of Building Information Modelling and Management [BIM(M)] in accordance with the UK Government's BIM maturity model, see Figure 1.

The levels categorise types of technical and collaborative working to enable a concise description and understanding of the processes, tools and techniques used. They are as follows:

- Level 0 – Unmanaged computer-aided design (CAD), probably 2D, and specifications on paper (or electronic paper) as the most likely data exchange mechanism.
- Level 1 – Managed CAD, in 2D or 3D format, using BS 1192 with a collaboration tool providing a common data environment and possibly some standard data structures and formats.

  NOTE 1 Commercial data is managed by standalone finance and cost management packages with no integration.

[2)] In preparation.

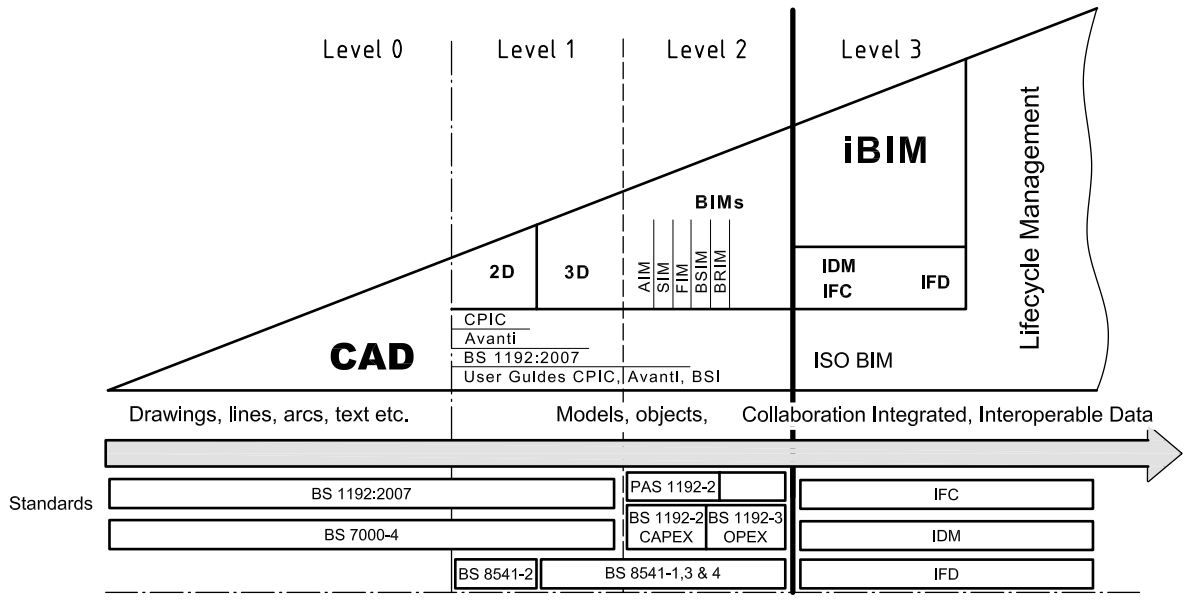
- Level 2 – Managed 3D environment held in separate discipline BIM tools with attached data.

  NOTE 2 Commercial data is managed by enterprise resource planning (ERP). Integration by proprietary interfaces or bespoke middleware can be regarded as "pBIM" (proprietary). This approach may utilize 4D programme data and 5D cost elements.

- Level 3 – Fully open process and data integration enabled by IFC and managed by a collaborative model server.

  NOTE 3 Can be regarded as integrated BIM ("iBIM") possibly employing concurrent engineering processes.

Figure 1 **Core maturity model**



NOTE 1 CAPEX, OPEX are potential standards.

NOTE 2 The BIM reports and an updated Roadmap are maintained by BIS[3] [7].

This British Standard applies to Level 1, Level 2 and Level 3, as the use of construction objects is increasingly relevant as the sector progressed beyond Level 0.

1 Scope

This part of BS 8541 gives recommendations for defining format and content for library objects to support project briefing, design, tendering, construction and management of built assets.

NOTE 1 A library object is intended for re-use within project teams and across organizations. This improves accuracy and buildability of designs, and improves the handover of information to the procurement chain and to the owner/operator.

It is intended for all professionals and service providers using generic and product specific data.

NOTE 2 This group includes product manufacturers, architects, engineers, contractors, owner occupiers, maintainers and commissioners.

It gives recommendations for defining library template objects, generic objects and product objects in data-driven library and design processes.

[3] http://www.bsigroup.com/en/sectorsandservices/Forms/BIM-reports/

Where the adoption of data-driven design is partial or incomplete, this British Standard gives recommendations for best practice. Where a particular project is formally committed to integrated working, this British Standard may be adopted as a requirement.

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 1192:2007, *Collaborative production of architectural, engineering and construction information – Code of practice*

BS ISO 10303-21, *Industrial automation systems and integration – Product data representation and exchange – Part 21: Implementation methods: Clear text encoding of the exchange structure*

ISO 10303-28, *Industrial automation systems and integration – Product data representation and exchange – Part 28: Implementation methods: XML representations of EXPRESS schema and data* [4)]

ISO/PAS 16739, *Industry foundation classes (IFC2x) platform specification* [5)]

3 Terms and definitions

For the purposes of this part of BS 8541, the following terms and definitions apply.

3.1 object

3.1.1 template object

type object intended to guide the production of generic objects and product objects by providing schedules of classification values and a minimum set of attributes

NOTE Typically the measurement type is specified, but the values are not.

3.1.2 generic object

type object intended for use in stages of design when the object is not resolved into a product

3.1.3 product object

type object intended to represent an obtainable product, either as a requirement or exemplar or as-built

3.1.4 type (library) object

representation of the common features of a product or group, including its classifications and properties

NOTE 1 It can be a template object, generic object or product object.

NOTE 2 It is independent of any occurrence, and has no placement in space. It can represent a template, generic or product object.

3.1.5 occurrence object

representation of an actual occurrence (instance) of an object in a building

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4) In preparation.

5) In the process of being converted to a full ISO standard.

4 Identification and origination of library objects

4.1 Structure and format

A library object should be published in a format that enables the transfer of information, both person-to-person and application-to-application.

*NOTE See **A.2**, **B.2** or **C.2** for file header and footer structure examples.*

4.2 Object

An object should be characterized to ensure that the object is unambiguously defined by choosing a type object and predefined type from the IFC schema from ISO/PAS 16739.

NOTE 1 See Annex D for a summary of the type objects and predefined types.

NOTE 2 An example of a type object and predefined (sub)type might be "IfcLightFixtureType" and "pointsource".

4.3 Identification

4.3.1 General

The object should be uniquely named and described.

NOTE 1 Maintaining identification information for a library object enables increased accuracy and efficiency for subsequent processes.

Names should be composed using characters A to Z, a to z, 0 to 9, and the _ underscore character. The following characters should not be used in names:

- ,. ! " £ $ % ^ & * ( ) { }[ ] + = < > ? | \ / @ ' ~ #¬ ` '

*NOTE 2 In **4.3.3**, the hyphen/minus character is allowed.*

4.3.2 Objects with associated classification attribute(s)

Where the object already carries classification information as data in its attributes, the object should be named to identify the origination (source or manufacturer), object type, and product or subtype, see Figure 2 and Table 1.

The name should use the _ underscore character as the delimiter and use CamelCase (no spaces, and capitalized words) to simplify phrases. No spaces or other punctuation should be used.

NOTE 1 For example, a construction object with classification attributes might be named "NBL_LightFixture _CeilingPendant".

Figure 2 **File and object naming for classified objects**

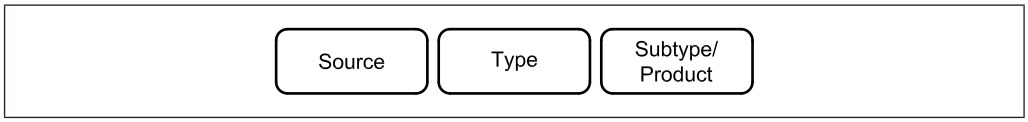

Table 1 **Information in names of library objects**

Source	Library author or manufacturer (may be omitted for generic objects).
Type	First level of specialization.
Subtype/Product code	(optional) Used to convey additional specialization information not captured in attribute data. Can be the predefined (sub)type.

4.3.3 Objects without associated classification attribute(s)

Where the object does not carry classification information as data in its attributes, the name should identify the object in accordance with BS 1192:2007, Clause **5**, which, in addition to **4.3.2**, includes a role, an external classification and a presentation classification, see Figure 3 and Table 2.

The role may be "LB" for library provider or "MN" for manufacturer.

The classification code should be taken from Table 3 and Table 4. Where objects are intended for international distribution, the classification text may be used in place of the classification code.

NOTE 1 This extended name can be derivable from the attributes of the object.

The name may use the _ underscore character as the delimiter and use the _ underscore character within phrases. No spaces or other punctuation should be used.

NOTE 2 For example, a manufacturer's construction object without classification attributes might be named "MN-L74-M3-Acme-LightFitting-Ceiling_Pendant_P9999". Where the object is intended for international use, the name might be "MN-Lighting-M3-Acme-LightFitting-Ceiling_Pendant_P9999".

NOTE 3 The use of the hyphen can disrupt parametric programming.

Figure 3 **File and object naming for otherwise unclassified objects**

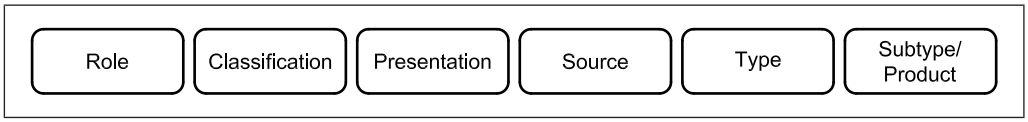

Table 2 **Additional information in names for library objects**

Role	Role of the object owner.
Classification (code or text)	Either a functional or product classification code from a UK system as in Table 3, or an equivalent generic classifying text.
Presentation	(optional) Indicating the "level of detail" or intended presentation of the model.
Source	See **4.3.1** and Table 1.
Type	See **4.3.1** and Table 1.
Subtype/product	See **4.3.1** and Table 1.

Table 3 **UK Construction classification conventions**

Name	Source	Basis
UK Uniclass Table L	www.cpic.org.uk [1] A)	Product
UK Uniclass Table G and Table H	www.cpic.org.uk [1] A)	Function
UK RICS BCIS Standard Form of Cost Analysis	www.bcis.co.uk [2] A)	Function
UK RICS BCIS Standard Form of Civil Engineering Cost Analysis	www.bcis.co.uk [2] A)	Function
UK RICS New Rules of Measurement	www.rics.org [3] A)	Function
UK Uniclass Table J and Table K	www.cpic.org.uk [1] A)	Work section

A) See classification convention source for publication edition and dates.

NOTE Preference may be given to classification conventions based on product and function. It might be harder to assign classification conventions based on work sections.

Table 4 **International and other classification conventions**

Name	Source	Basis
UNSPSC	www.unspsc.org/ [4] A)	Product
Omniclass	www.omniclass.org/ [5] A)	Various

A) See classification convention source for publication edition and dates.

4.3.4 Description

The description should include supporting information relevant to selection and scheduling. For product objects, the manufacturer's trade and catalogue name should be provided.

4.3.5 Unique identifier

The object should be given a randomly generated, globally unique 22-character identifier conforming to the IFC standard (ISO/PAS 16739).

*NOTE See **A.3**, **B.3** or **C.3** for library object identification examples.*

4.4 Origination

The origination of the library object should be clearly defined as the organization responsible. The organization should be identified by an email address and may be further identified by name, postal address and electronic address details. It may additionally include the departmental or individual's contact details.

The date and name of any application used in the preparation of the object should be provided.

NOTE 1 As with printed product data, library objects can be originated by product manufacturers under specific copyright and usage licences and disclaimers, which might restrict data alteration or interference with the origination information.

*NOTE 2 See **A.4**, **B.4** or **C.4** for origination examples.*

4.5 Classification

The classification system, code and description should be identified.

NOTE 1 Maintaining classification information for a construction object can enable increased accuracy and efficiency for subsequent processes.

At least one classification to a UK convention should be provided, see Table 3.

Where it is not possible to document these separately, the classification system and code should be separated from the descriptive text using a colon. The classification system may be omitted where it is implied by the classification code it may be omitted. The descriptive text should not contain punctuation.

NOTE 2 For example, a classification system "UK Uniclass 1999", classification code "L7473", and classification text "Fixed luminaires" may be presented as "UK Uniclass 1999 L7473: Fixed luminaires" or "L7473: Fixed luminaires".

NOTE 3 The IFC schema supports multiple classifications and supports the separate documentation of these three items of information.

Classification to international and other conventions may also be provided, see Table 4.

The classification code should be as specific as possible.

The classification conventions should be used accurately, particularly with regard to the punctuation, character case and spaces in the classification code.

*NOTE 4 See **A.5**, **B.5** or **C.5** for classification examples.*

4.6 Supplementary information

The type object should be associated to an appropriate system of units of measure. It may also be related to an occurrence object.

If an occurrence object is provided, it should be given context by being located in a space, a building story, a building, site and project, sufficient for it to be recognized in a report or visualization.

An occurrence object should not appear without a type object.

*NOTE See **A.6**, **B.6** or **C.6** for supplementary context examples.*

4.7 Conformity

The library object should conform to:

- BS ISO 10303-21 or ISO 10303-28;
- ISO/PAS 16739 schema; and
- the additional rules defined by **4.1** to **4.6**.

NOTE 1 Where library templates, and generic and manufacturer's library objects can be shown to generate models in accordance with this British Standard, they may be supplied in application-specific formats .

NOTE 2 Compliance to this British Standard does not warrant the data transmitted.

Annex A (informative) COBie examples

A.1 General

COBie is formal schema that helps sharing structured information about new and existing facilities and their constituent products. It can be used to document both buildings and infrastructure assets. It can be transmitted using a spreadsheet.

NOTE For examples, see Table A.1 to Table A.7.

COBie is required as part of the UK Government BIM strategy.

See [5] for the COBie standard, which is defined as the FM Handover MVD and contains the terms of the COBie license. The COBie spreadsheet is a mapping of the FM Handover MVD as documented in the COBie responsibility matrix [6].

A.2 Header and footer example

Table A.1 **COBie instruction sheet**

Title	**COBie**
Version	2
Release	4
Status	IFC2x3
Region	en-UK

A.3 Object and identity example

Table A.2 **COBie type sheet**

Name	CreatedBy (lookup)	CreatedOn	Category (lookup)	Description	AssetType (lookup)	Manufacturer (lookup)	ModelNumber
MyCompany MC999 Basin 470w x 300d	sales@ MyCompany. co.uk	2012-01-20T10:01:14	L72104 : Washbasins	MC180 basin has hidden services and through wall fixings made from the highest grade solid surface materials.	Fixed	sales@ MyCompany. co.uk	MC999

A.4 Origination example

Table A.3 **COBie contact sheet**

Email	CreatedBy (lookup)	CreatedOn	Category (lookup)	Company	Phone
sales@MyCompany. co.uk	sales@MyCompany. co.uk	2012-02-15T16:03:03	C3891: Manufacturers	MyCompany Ltd	01999 999 999

A.5 Classification example

See **C.3**.

A.6 Context example

Table A.4 **COBie component (occurrence objects) sheet**

Name	CreatedBy (lookup)	CreatedOn	TypeName (lookup)	Space
MyCompany MC999 Basin:470w x 300d:470w x 300d:211813	sales@MyCompany.co.uk	2012-01-19T12:27:24	MyCompany MC999 Basin 470w x 300d	L0-01A
MyCompany MC999 Basin:470w x 300d:470w x 300d:211808	sales@MyCompany.co.uk	2012-01-19T12:27:24	MyCompany MC999 Basin 470w x 300d	L0-02B

Table A.5 **COBie space sheet**

Name	CreatedBy (lookup)	CreatedOn	Category (lookup)	FloorName (lookup)	Description
L0-01A	sales@MyCompany.co.uk	2012-01-19T12:27:24	F D376: Detention secure facilities prisons	Level 0	Cell 1
L0-02B	sales@MyCompany.co.uk	2012-01-19T12:27:24	F D376: Detention secure facilities prisons	Level 0	Cell 2

Table A.6 **COBie floor (sector) sheet**

Name	CreatedBy (lookup)	CreatedOn	Category (lookup)
Level 0	sales@MyCompany.co.uk	2012-01-19T12:27:24	Floor

Table A.7 **COBie facility sheet**

Name	CreatedBy (lookup)	CreatedOn	Category (lookup)	ProjectName	SiteName
StandardCell	sales@MyCompany.co.uk	2012-01-19T12:27:24	D376: Detention secure facilities prisons	StandardCell	StandardCell

Annex B (informative) ISO 10303 part 28 "XML" format

B.1 General

The header is defined in ISO 10303-28. It references the current IFC schema and other W3C and ISO 10303-28 schemas.

The content is defined by the IFC schema, which is documented at www.buildingsmart.org [8] and www.buildingsmart-tech.org [9].

B.2 Header example

<?xml version="1.0" encoding="UTF-8"?> <ex:ISO_10303_28 xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:ex="urn:ISO.org:standard:10303:part(28):version(2):xmlschema:common" xmlns="http://www.iai-tech.org/ifcXML/IFC2x3/FINAL" xsi:schemaLocation="http://www.iai-tech.org/ifcXML/IFC2x3/FINAL IFC2X3.xsd" version="2.0"> <ex:ISO_10303_28_header> <ex:name>IFC Engine DLL test</ex:name> <ex:time_stamp>2006-03-31T16:51:19</ex:time_stamp> <ex:author>Architect</ex:author> <ex:organization>Building Designer Office</ex:organization> <ex:preprocessor_version>test</ex:preprocessor_version> <ex:originating_system>Windows System</ex:originating_system> <ex:authorization>The authorising person.</ex:authorization> <ex:documentation>IFC Engine 1.10</ex:documentation> </ex:ISO_10303_28_header> <uos id="uos_1" description="" edo="" configuration="default" xmlns="http://www.iai-tech.org/ifcXML/IFC2x3/FINAL" xsi:schemaLocation="http://www.iai-tech.org/ifcXML/IFC2x3/FINAL http://www.iai-tech.org/ifcXML/IFC2x3/FINAL/IFC2X3.xsd">	The ISO 10303-28 header section can be used to provide metadata about the file, see ISO/PAS 16739 for further guidance.
Insert data here, see **B.2**, **B.3**, **B.4**, **B.5** and **B.6**:	
</uos> </ex:ISO_10303_28>	

B.3 Object and identity example (1 of 2)

<IfcLightFixtureType id="i100005"> <GlobalId>12345678901234567890000</GlobalId> <OwnerHistory> <IfcOwnerHistory xsi:nil="true" ref="i100006"/> </OwnerHistory> <Name>LightFixture_POINTSOURCE_UK</Name> <Description>Example light fixture point source</Description> <HasPropertySets ex:cType="set"> <IfcPropertySet pos="0" xsi:nil="true" ref="i100007"/> </HasPropertySets> <RepresentationMaps ex:cType="list-unique"> <IfcRepresentationMap pos="0" xsi:nil="true" ref="i100078"/> </RepresentationMaps> <Tag>Product Template </Tag> <ElementType/> <PredefinedType>pointsource</PredefinedType> </IfcLightFixtureType>	An IFC Type object, e.g. "IfcLightFixtureType" defines the library object. The "GlobalId" tag contains a unique 22-character string using the IFC recommended character set and encoding. The use of temporary "id" and "ref" keys is described in the XLINK section of the IFC IFCXML guidance. The keys are not numeric. The values allowed for the "PredefinedType" tag are listed in Annex D.
<IfcFlowTerminal id="i100087"> <GlobalId>37N4UypQzHIfXhrSJ8E8EP</GlobalId> <OwnerHistory> <IfcOwnerHistory xsi:nil="true" ref="i100006"/> </OwnerHistory> <Name>LightFixture_POINTSOURCE_UK_Instance</Name> <Description>Light Fixture POINT SOURCE UK Instance</Description> <ObjectType>COMPONENT</ObjectType>	An IFC object, e.g. "IfcFlowTerminal", can be used to define the occurrence object with positioning within a building model.

B.3 Object and identity example (2 of 2)

<ObjectPlacement> <IfcLocalPlacement xsi:nil="true" ref="i100088"/> </ObjectPlacement> <Representation> <IfcProductDefinitionShape xsi:nil="true" ref="i100094"/> </Representation> <Tag>element</Tag> </IfcFlowTerminal>	
<IfcRelDefinesByType> <GlobalId>12345678901234567890 01</GlobalId> <OwnerHistory> <IfcOwnerHistory xsi:nil="true" ref="i100006"/> </OwnerHistory> <Name>Type_to_Instance</Name> <Description>relate Type to Instance</Description> <RelatedObjects ex:cType="set"> <IfcFlowTerminal pos="0" xsi:nil="true" ref="i100087"/> </RelatedObjects> <RelatingType>	The relationship between the type (library) object and the occurrence object is explicit.
<IfcLightFixtureType xsi:nil="true" ref="i100005"/> </RelatingType> </IfcRelDefinesByType>	
NOTE For representation and object placement, see BS 8541-3[6)].	

[6)] In preparation.

B.4 Origination example (1 of 5)

<IfcOwnerHistory id="i100006"> <OwningUser>	Owner history may be associated to many IFC objects and relationships.
<IfcPersonAndOrganization id="i100124"> <ThePerson> <IfcPerson id="i100125"> <Id>nn@buildingsmart.org.uk</Id> <FamilyName>Nisbet</FamilyName> <GivenName>Nicholas</GivenName> <PrefixTitles ex:cType="list">	The "IfcPersonAndOrganization" tag may be replaced with an "IfcOrganization" tag if no person or role is specified.
<IfcLabel>Director</IfcLabel> </PrefixTitles> <SuffixTitles ex:cType="list"> <IfcLabel>Director of buildingSMART UKI</IfcLabel> </SuffixTitles> <Roles ex:cType="list"> <IfcActorRole pos="0" xsi:nil="true" ref="ar1"/> </Roles> <Addresses ex:cType="list"> <IfcTelecomAddress pos="0" xsi:nil="true" ref="ta1"/> <IfcPostalAddress pos="1" xsi:nil="true" ref="pa1"/> </Addresses> </IfcPerson> </ThePerson> <TheOrganization>	An email address may be used as the identifier for a person or for an organization.

B.4 Origination example (2 of 5)

<IfcOrganization xsi:nil="true" ref="i100126"/> </TheOrganization> </IfcPersonAndOrganization> </OwningUser> <OwningApplication> <IfcApplication id="i100127"> <ApplicationDeveloper> <IfcOrganization xsi:nil="true" ref="i100126"/> </ApplicationDeveloper> <Version>v3.1</Version> <ApplicationFullName>AEC3_BimServices</ApplicationFullName> <ApplicationIdentifier>AEC3_BimServices</ApplicationIdentifier> </IfcApplication> </OwningApplication> <ChangeAction>nochange</ChangeAction> <CreationDate>1069351375</CreationDate> </IfcOwnerHistory>	The originating organization is detailed under the "OwningUser" tag. The application used to generate the data may be detailed under the "OwningApplication" tag. The IFC schema requires that the date in the "CreationDate" tag is measured in seconds from the year 1970.
<IfcOrganization id="i100126"> <Id>nn@buildingsmart.org.uk</Id> <Name>buildingSMART UKI</Name> <Description>buildingSMART UK and Ireland</Description> </IfcOrganization>	The identifier for an organization may be an email or other distinct code.

B.4 Origination example (3 of 5)

<IfcPostalAddress id="i100128"> <AddressLines ex:cType="list"> <IfcLabel>2 Church Road</IfcLabel> </AddressLines> <Town> Kenley </Town> <Region>Surrey</Region> <PostalCode>CR8 5DU</PostalCode> <Country>United Kingdom</Country> </IfcPostalAddress>	Where necessary, a postal address may have multiple lines.
<IfcTelecomAddress id="i100129"> <TelephoneNumbers ex:cType="list"> <IfcLabel>+ 44 20 8660 1631</IfcLabel> </TelephoneNumbers> <FacsimileNumbers ex:cType="list"> <IfcLabel>>+ 44 20 8660 1631</IfcLabel> </FacsimileNumbers> <ElectronicMailAddresses ex:cType="list"> <IfcLabel>nn@buildingsmart.org.uk</IfcLabel> </ElectronicMailAddresses> <WWWHomePageURL>http://www.buildingsmart.org.uk</WWWHomePageURL> </IfcTelecomAddress>	Multiple telephone, fax and email addresses may be listed.

B.4 Origination example (4 of 5)

```
<IfcPropertySet id="i100043">
     <GlobalId>1234567890123456789300</GlobalId>
     <OwnerHistory>
          <IfcOwnerHistory xsi:nil="true" ref="i100006"/>
     </OwnerHistory>
     <Name>Pset_ManufacturerTypeInformation</Name>
     <Description>Properties for ManufacturerTypeInformation</Description>
     <HasProperties ex:cType="set">
          <IfcPropertySingleValue >
               <Name>ModelReference</Name>
               <Description>The name used by the manufacturer</Description>
               <NominalValue>
                    <IfcText>NotDefined</IfcText>
               </NominalValue>
          </IfcPropertySingleValue>
          <IfcPropertySingleValue>
               <Name>ModelLabel</Name>
               <Description> The model number assigned by manufacturer.</Description>
               <NominalValue>
                    <IfcText>NotDefined</IfcText>
               </NominalValue>
          </IfcPropertySingleValue>
          <IfcPropertySingleValue id="i100046">
               <Name>Manufacturer</Name>
```

A manufactured product is associated with the manufacturer and product details.

B.4 Origination example (5 of 5)

<Description>The organization that manufactured and/or assembled the item.</Description> <NominalValue> <IfcText>NotDefined</IfcText> </NominalValue> </IfcPropertySingleValue> </HasProperties> </IfcPropertySet>	
<IfcActorRole id="i100130"> <Role>reseller</Role> <Description>Director of library services</Description> </IfcActorRole>	

B.5 Classification example (1 of 3)

<IfcRelAssociatesClassification> <GlobalId>12345678901234567890002</GlobalId> <OwnerHistory> <IfcOwnerHistory xsi:nil="true" ref="i100006"/> </OwnerHistory> <Name>Light Fixture in UK Uniclass tables J and K</Name> <Description> Light Fixture in UK Uniclass tables J and K</Description> <RelatedObjects ex:cType="set"> <IfcLightFixtureType pos="0" xsi:nil="true" ref=" i100005"/> </RelatedObjects> <RelatingClassification>	The classification relationship associates the product type with a full description of the classification reference and its classification system.

B.5 Classification example (2 of 3)

<IfcClassificationReference id="i100126"> <Location>http://www.cpic.com/tables#G541</Location> <ItemReference>G541</ItemReference> <Name>Lighting general</Name> <ReferencedSource> <IfcClassification id="i10"> <Source> UK Uniclass tables J and K </Source> <Edition>Current</Edition> <EditionDate> <IfcCalendarDate xsi:nil="true" ref="i100131"/> </EditionDate> <Name> UK Uniclass tables J and K </Name> </IfcClassification> </ReferencedSource> </IfcClassificationReference> </RelatingClassification> </IfcRelAssociatesClassification>	
<IfcDateAndTime id="i100131"> <DateComponent> <IfcCalendarDate > <DayComponent>7</DayComponent> <MonthComponent>3</MonthComponent> <YearComponent>2011</YearComponent> </IfcCalendarDate> </DateComponent> <TimeComponent> <IfcLocalTime >	A date and time (other than the creation date) may be specified.

B.5 Classification example (3 of 3)

```
                <HourComponent>11</HourComponent>
                <MinuteComponent>4</MinuteComponent>
                <SecondComponent>8.</SecondComponent>
           </IfcLocalTime>
      </TimeComponent>
</IfcDateAndTime>
```

B.6 Context example (1 of 2)

```
<IfcProject id="i100100">
     <GlobalId>1SPieHPPIP123456789012</GlobalId>
     <OwnerHistory>
          <IfcOwnerHistory xsi:nil="true" ref="i100006"/>
     </OwnerHistory>
     <Name>PLF1</Name>
     <Description>Project for light fixture example </Description>
     <ObjectType/>
     <LongName>Project for light fixture example </LongName>
     <Phase>design</Phase>
     <RepresentationContexts ex:cType="set">
          <IfcGeometricRepresentationContext id="i100081">
               <ContextType>Model</ContextType>
               <CoordinateSpaceDimension>3</CoordinateSpaceDimension>
               <Precision>1.E-8</Precision>
               <WorldCoordinateSystem>
                    <IfcAxis2Placement3D xsi:nil="true" ref="i100079"/>
               </WorldCoordinateSystem>
```


B.6 Context example (2 of 2)

</IfcGeometricRepresentationContext> </RepresentationContexts> <UnitsInContext> <IfcUnitAssignment> <Units ex:cType=”set”> <IfcSIUnit id=”i100037”> <UnitType>lengthunit</UnitType> <Prefix>milli</Prefix> <Name>metre</Name> </IfcSIUnit> </Units> </IfcUnitAssignment> </UnitsInContext> </IfcProject>	A definition of the length units in use is provided. Definitions can specify any metric and non-metric unit.

Annex C (informative) ISO 10303 part 21 “STEP file” format

C.1 General

The header is defined in ISO 10303-21. It references the current IFC schema.

The content is defined by the IFC schema, which is documented at www.buildingsmart.org [8] and www.buildingsmart-tech.org [9].

C.2 Header and footer example

```
ISO-10303-21;

HEADER;

FILE_DESCRIPTION (('Transform1', 'File generated by BimServices nn@aec3.com AEC3 UK Ltd
(c) 2010-12-28:12:00:00', 'ViewDefinition [CoordinationView]'), '2;1');

FILE_NAME ('Model 001', '2010-12-28:12:00:00', ('Nisbet', 'Nicholas'), ('AEC3 UK Ltd'), 'BimServices',
'BimServices Transform1 v2010-12-28:12:00:00', ' using TNO IfcEngine for USACE ERDC.');
```

```
FILE_SCHEMA (('IFC2X3'));
ENDSEC;
DATA;
data appears here)
ENDSEC;
END-ISO-10303-21;
```

C.3 Object and identity example

```
#100005 = IFCLIGHTFIXTURETYPE('1SPieHPtyp999D0EICD999', #100006, 'LightFixture_POINTSOURCE_
LightFixture_US', '', $, (#100007, #100022, #100031, #100043, #100047, #100066, #100072, #100076),
(#100078), 'Light Fixture Template', '', .POINTSOURCE.);
#100087 = IFCFLOWTERMINAL('1SPieHPocc999D0EICD999', #100006, 'LightFixture_Example', 'Light Fixture
example', 'COMPONENT', #100088, #100094, 'element');
#100099 = IFCRELDEFINESBYTYPE('1SPieHPdbt999D0EICD999', #100006, 'Type_to_Instance', 'relate Type to
Instance', (#100087), #100005);
```

NOTE For representation and object placement, see BS 8541-3[7)].

C.4 Origination example

```
#100006 = IFCOWNERHISTORY(#100124, #100127, $, .NOCHANGE., $, $, $, 1069351375);
#100124 = IFCPERSONANDORGANIZATION(#100125, #100126, $);
#100125 = IFCPERSON('nn@buildingsmart.org.uk', 'Nisbet ', 'Nicholas', $, ('Director'), ('Director of
buildingSMART UKI'), (#100130), (#100129));
#100126 = IFCORGANIZATION('nn@buildingsmart.org.uk', 'buildingSMART UKI ', buildingSMART UKI ', $, $);
#100127 = IFCAPPLICATION(#100126, 'v3.1', 'AEC3_BimServices', 'AEC3_BimServices');
#100128 = IFCPOSTALADDRESS($, $, $, $, (2 Church Road'), $, ', Kenley', ' Surrey ', ' CR8 5DU ',
'United Kingdome');
#100129 = IFCTELECOMADDRESS($, $, $, ('+ 44 20 8660 1631 '), ('+ 44 20 8660 1631 '), $, ('nn@
buildingsmart.org.uk'), 'http://www.buildingsmart.org.uk');
#100130 = IFCACTORROLE(.RESELLER., $, ''Director of buildingSMART UKI);
```

7) In preparation.

C.5 Classification example

```
#11 = IFCCLASSIFICATION('UK Uniclass tables J and K', 'Current', #100000, UK Uniclass tables J and K ');

#100123 = IFCRELASSOCIATESCLASSIFICATION('1SPieHPrac999D0ENXBct1', #100006, 'Light Fixture to
Uniclass Table J and K', Light Fixture to Uniclass Table J and K', (#100005), #100124);

#100124 = IFCCLASSIFICATIONREFERENCE('http://www.cpic.com/tables#G541', G541', 'Lighting General', #11);
```

C.6 Context example

```
#100100 = IFCPROJECT('1SPieHPprj999D0EICD999', #100006, Project context', 'Project context, '',
'Project Template', 'design', (#100081), #100101);
```

NOTE *See **B.5** for an example of the objects that may be used to give full context to a product.*

Annex D Summary of the IFC vocabulary

The types and predefined types are defined by the IFC2x4 schema, which is documented at www.buildingsmart.org [8] and www.buildingsmart-tech.org [9].

Table D.1 **IFC type (library) object and predefined types with descriptions**

Library object (IFC*Type) [A]	**Predefined type and description** [B]
Actuator	ELECTRICACTUATOR: A device that electrically actuates a control element.
	HANDOPERATEDACTUATOR: A device that manually actuates a control element.
	HYDRAULICACTUATOR: A device that electrically actuates a control element.
	PNEUMATICACTUATOR: A device that pneumatically actuates a control element.
	THERMOSTATICACTUATOR: A device that thermostatically actuates a control element.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
AirTerminal	DIFFUSER: An outlet discharging supply air in various directions and planes.
	GRILLE: A covering for any area through which air passes.
	LOUVRE: A rectilinear louvre.
	REGISTER: A grille typically equipped with a damper or control valve.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	Predefined type and description[B]
AirTerminalBox	CONSTANTFLOW: Terminal box does not include a means to reset the volume automatically to an outside signal such as a thermostat.
	VARIABLEFLOWPRESSUREDEPENDANT: Terminal box includes a means to reset the volume automatically to a different control point in response to an outside signal such as a thermostat; air-flow rate is dependent on supply pressure.
	VARIABLEFLOWPRESSUREINDEPENDANT: Terminal box includes a means to reset the volume automatically to a different control point in response to an outside signal such as a thermostat; air-flow rate is independent of supply pressure.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
AirToAirHeatRecovery	FIXEDPLATECOUNTERFLOWEXCHANGER: Heat exchanger with moving parts and alternate layers of plates separated and sealed from the exhaust and supply air stream passages with primary air entering at the secondary air outlet location and exiting at the secondary air inlet location.
	FIXEDPLATECROSSFLOWEXCHANGER: Heat exchanger with moving parts and alternate layers of plates separated and sealed from the exhaust and supply air stream passages with secondary air flow in the direction perpendicular to the primary air flow.
	FIXEDPLATEPARALLELFLOWEXCHANGER: Heat exchanger with moving parts and alternate layers of plates separated and sealed from the exhaust and supply air stream passages with primary air entering at the secondary air inlet location and exiting at the secondary air outlet location.
	HEATPIPE: A passive energy recovery device with a heat pipe divided into evaporator and condenser sections.
	ROTARYWHEEL: A heat wheel with a revolving cylinder filled with an air-permeable medium having a large internal surface area.
	RUNAROUNDCOILLOOP: A typical coil energy recovery loop places extended surface, finned tube water coils in the supply and exhaust airstreams of a building.
	THERMOSIPHONCOILTYPEHEATEXCHANGER: Sealed system, consisting of an evaporator, a condenser, interconnecting piping and an intermediate working fluid that is present in both liquid and vapour phases, where the evaporator and condenser coils are installed independently in the ducts and are interconnected by the working fluid piping.
	THERMOSIPHONSEALEDTUBEHEATEXCHANGER: Sealed system, consisting of an evaporator, a condenser, interconnecting piping and an intermediate working fluid that is present in both liquid and vapour phases, where the evaporator and the condenser are usually at opposite ends of a bundle of straight; individual thermosiphon tubes and the exhaust and supply ducts are adjacent to each other.
	TWINTOWERENTHALPYRECOVERYLOOPS: An air-to-liquid, liquid-to-air enthalpy recovery system with a sorbent liquid circulating continuously between supply and exhaust airstreams, alternately contacting both airstreams directly in contactor towers.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	Predefined type and description[B)]
AirToAirHeatRecovery (cont.)	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Alarm	BELL: An audible alarm.
	BREAKGLASSBUTTON: An alarm activation mechanism in which a protective glass has to be broken to enable a button to be pressed.
	LIGHT: A visual alarm.
	MANUALPULLBOX: An alarm activation mechanism in which activation is achieved by a pulling action.
	SIREN: An audible alarm.
	WHISTLE: An audible alarm.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
AudioVisualAppliance	AMPLIFIER: A device that receives an audio signal and amplifies it to play through speakers.
	CAMERA: A device that records images, either as a still photograph or as moving images known as videos or movies. *NOTE 1 A camera may operate with light from the visible spectrum or from other parts of the electromagnetic spectrum such as infrared or ultraviolet.*
	DISPLAY: An electronic device that represents information in visual form, e.g. flat-panel display or television.
	MICROPHONE: An acoustic-to-electric transducer or sensor that converts sound into an electrical signal. *NOTE 2 Microphone types in use include electromagnetic induction (dynamic microphones), capacitance change (condenser microphones) or piezoelectric generation (producing the signal from mechanical vibration).*
	PLAYER: A device that plays audio and/or video content directly to another device, having fixed or removable storage media.
	PROJECTOR: An apparatus for projecting a picture on a screen. *NOTE 3 Overhead, slide, or film projectors are usually known as projectors.*
	RECEIVER: A device that receives audio and/or video signals, switches sources, and amplifies signals to play through speakers.
	SPEAKER: A loudspeaker, speaker, or speaker system is an electro-acoustical transducer that converts an electrical signal to sound.
	SWITCHER: A device that receives audio and/or video signals, switches sources, and transmits signals to downstream devices.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
AudioVisualAppliance (cont.)	TELEPHONE: A telecommunications device that is used to transmit and receive sound, and optionally video.
	TUNER: An electronic receiver that detects, demodulates and amplifies transmitted signals.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Beam	BEAM: A standard beam usually used horizontally.
	JOIST: A beam used to support a floor or ceiling.
	HOLLOWCORE: A wide, often pre-stressed, beam with a hollow-core profile that usually serves as a slab component.
	LINTEL: A beam or horizontal piece of material over an opening (e.g. door, window).
	SPANDREL: A tall beam placed on the facade of a building. *NOTE 4 One tall side is usually finished to provide the exterior of the building. It may be used to support joists or slab elements on its interior side.* *NOTE 5 They are also known as "spandrel panels", which are parts of a facade and sometimes have supporting consoles for floor slabs integrated.*
	T-BEAM: A beam that forms part of a slab construction and acts together with the slab which its carries. *NOTE 6 T-beams are often of T-shape, but may have other shapes as well, e.g. an L-Shape or an Inverted-T-Shape.* *NOTE 7 To distinguish beams by shape, the assigned IfcProfileDef subtypes provide the shape type and, if using a subtype of IfcParameterizedProfileDef, also the shape parameterization.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Boiler	STEAM: Steam boiler.
	WATER: Water boiler.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
BuildingElementPart	INSULATION: The part that provides thermal insulation, e.g. as an insulation layer between wall panels in sandwich walls, as infill in stud walls.
	PRECASTPANEL: The part that is precast, usually used as an internal or external layer in a sandwich wall panel.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
BuildingElementProxy	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Burner	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CableCarrierFitting	BEND: A fitting that changes the route of the cable carrier.
	CROSS: A fitting at which two branches are taken from the main route of the cable carrier simultaneously.
	REDUCER: A fitting that changes the physical size of the main route of the cable carrier.
	TEE: A fitting at which a branch is taken from the main route of the cable carrier.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CableCarrierSegment	CABLELADDERSEGMENT: An open carrier segment on which cables are carried on a ladder structure.
	CABLETRAYSEGMENT: A (typically) open carrier segment onto which cables are laid.
	CABLETRUNKINGSEGMENT: An enclosed carrier segment with one or more compartments into which cables are placed.
	CONDUITSEGMENT: An enclosed tubular carrier segment through which cables are pulled.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CableFitting	CONNECTOR: A fitting that joins two cable segments of the same connector type (though potentially different gender).
	ENTRY: A fitting that begins a cable segment at a non-electrical element such as a grounding clamp attached to a pipe.
	EXIT: A fitting that ends a cable segment at a non-electrical element such as a grounding clamp attached to a pipe or to the ground.
	JUNCTION: A fitting that joins three or more segments of arbitrary connector types for signal splitting or multiplexing.
	TRANSITION: A fitting that joins two cable segments of different connector types.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
CableSegment	BUSBARSEGMENT: Electrical conductor that makes a common connection between several electrical circuits. *NOTE 8 Properties of a busbar are the same as those of a cable segment and are captured by the cable segment property set.*
	CABLESEGMENT: Cable that leads electric current within a circuit or any other electric construction. *NOTE 9 This includes all types of electric cables, mainly several core segments or conductor segments wrapped together.*
	CONDUCTORSEGMENT: A single linear element within a cable or an exposed wire (such as for grounding) that leads electric current, data, or a telecommunications signal.
	CORESEGMENT: A self-contained element of a cable that comprises one or more conductors and sheathing. *NOTE 10 The core of one lead is usually single wired or multi-wired, which are intertwined.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Chiller	AIRCOOLED: Air-cooled chiller.
	HEATRECOVERY: Heat-recovery chiller.
	WATERCOOLED: Water-cooled chiller.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Chimney	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Coil	DXCOOLINGCOIL: Cooling coil using a refrigerant to cool the air stream directly.
	ELECTRICHEATINGCOIL: Heating coil using electricity as a heating source.
	GASHEATINGCOIL: Heating coil using gas as a heating source.
	HYDRONICCOIL: Cooling or heating coil that uses a hydronic fluid as a cooling or heating source.
	STEAMHEATINGCOIL: Heating coil that uses steam as a heating source.
	WATERCOOLINGCOIL: Cooling coil that uses chilled water. *NOTE 11 HYDRONICCOIL supersedes this enumerator.*
	WATERHEATINGCOIL: Heating coil that uses hot water as a heating source. *NOTE 12 HYDRONICCOIL supersedes this enumerator.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
Column	COLUMN: A standard column usually used vertically.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CommunicationsAppliance	ANTENNA: A transducer designed to transmit or receive electromagnetic waves.
	COMPUTER: A desktop, laptop, PDA or other type of computer that can be moved from one place to another and connected to an electrical supply via a plugged outlet.
	FAX: A machine that has the primary function of transmitting a facsimile copy of printed matter using a telephone line.
	GATEWAY: A gateway connects multiple network segments with different protocols at all layers (layers 1-7) of the OSI model.
	MODEM: A modem (from modulator-demodulator) is a device that modulates an analog carrier signal to encode digital information and also demodulates such a carrier signal to decode the transmitted information.
	NETWORKAPPLIANCE: A network appliance performs a dedicated function, e.g. firewall protection, content filtering, load balancing or equipment management.
	NETWORKBRIDGE: A network bridge connects multiple network segments at the data link layer (layer 2) of the OSI model. *NOTE 13 The term Layer 2 switch can be used interchangeably with bridge.*
	NETWORKHUB: A network hub connects multiple network segments at the physical layer (layer 1) of the OSI model.
	PRINTER: A machine that has the primary function of printing text and/or graphics onto paper or other media.
	REPEATER: A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so the signal can cover longer distances without degradation.
	ROUTER: A router is a networking device whose software and hardware are usually tailored to the tasks of routing and forwarding information, e.g. on the Internet, information is directed to various paths by routers.
	SCANNER: A machine that has the primary function of scanning the content of printed matter and converting it to digital format that can be stored in a computer.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Compressor	BOOSTER: Positive-displacement reciprocating compressor where pressure is increased by a booster.
	DYNAMIC: The pressure of refrigerant vapour is increased by a continuous transfer of angular momentum from a rotating member to the vapour followed by conversion of this momentum into static pressure.
	HERMETIC: Positive-displacement reciprocating compressor where the motor and compressor are contained within the same housing, with the motor shaft integral with the compressor crankshaft and the motor in contact with the refrigerant.
	OPENTYPE: Positive-displacement reciprocating compressor where the shaft extends through a seal in the crankcase for an external drive.
	RECIPROCATING: Positive-displacement compressor using a piston driven by a connecting rod from a crankshaft.
	ROLLINGPISTON: Positive-displacement rotary compressor using a roller mounted on the eccentric of a shaft with a single vane in the non-rotating cylindrical housing.
	ROTARY: Positive-displacement compressor using a roller or rotor device.
	ROTARYVANE: Positive-displacement rotary compressor using a roller mounted on the eccentric of a shaft with multiple vanes in the non-rotating cylindrical housing.
	SCROLL: Positive-displacement compressor using two inter-fitting, spiral-shaped scroll members.
	SEMIHERMETIC: Positive-displacement reciprocating compressor where the hermetic compressors use bolted construction amenable to field repair.
	SINGLESCREW: Positive-displacement rotary compressor using a single, cylindrical main rotor that works with a pair of gate rotors.
	SINGLESTAGE: Positive-displacement reciprocating compressor where vapour is compressed in a single stage.
	TROCHOIDAL: Positive-displacement compressor using a rolling motion of one circle outside or inside the circumference of a basic circle that produces either epitrochoids or hypotrochoids.
	TWINSCREW: Positive-displacement rotary compressor using two mating helically grooved rotors, male (lobes) and female (flutes), in a stationary housing with inlet and outlet gas ports.
	WELDEDSHELLHERMETIC: Positive-displacement reciprocating compressor where the motor compressor is mounted inside a steel shell, which, in turn is sealed by welding.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Condenser	AIRCOOLED: A condenser in which heat is transferred to an air-stream.
	EVAPORATIVECOOLED: A condenser that is cooled by evaporation.
	WATERCOOLED: Water-cooled condenser with unspecified operation.
	WATERCOOLEDBRAZEDPLATE: Water-cooled condenser with plates brazed together to form an assembly of separate channels.
	WATERCOOLEDSHELLCOIL: Water-cooled condenser with cooling water circulated through one or more continuous or assembled coils contained within the shell.
	WATERCOOLEDSHELLTUBE: Water-cooled condenser with cooling water circulated through one or more tubes contained within the shell.
	WATERCOOLEDTUBEINTUBE: Water-cooled condenser consisting of one or more assemblies of two tubes, one within the other.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Controller	FLOATING: Output increases or decreases at a constant or accelerating rate.
	MULTIPOSITION: Output is a discrete value, which can be one of three or more values.
	PROGRAMMABLE: Output is programmable, e.g. Discrete Digital Control (DDC).
	PROPORTIONAL: Output is proportional to the control error and optionally time integral and derivative.
	TWOPOSITION: Output can be either on or off.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CooledBeam	ACTIVE: An active or ventilated cooled beam provides cooling (and heating), but can also function as an air terminal in a ventilation system.
	PASSIVE: A passive or static cooled beam that provides cooling (and heating) to a room or zone.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
CoolingTower	MECHANICALFORCEDDRAFT: Airflow is produced by a mechanical device, typically one or more fans, located on the inlet air side of the cooling tower.
	MECHANICALINDUCEDDRAFT: Airflow is produced by a mechanical device, typically one or more fans, located on the air outlet side of the cooling tower.
	NATURALDRAFT: Airflow is produced naturally.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Covering	CEILING: The covering is used to represent a ceiling.
	CLADDING: The covering is used to represent a cladding.
	FLOORING: The covering is used to represent a flooring.
	INSULATION: The covering is used to insulate an element for thermal or acoustic purposes. *NOTE 14 For IFC2x4, the use of this enumerator is deprecated* [B)]*.*
	MEMBRANE: An impervious layer that could be used for roof covering (below tiling that may be known as sarking, etc.) or as a damp proof course membrane. *NOTE 15 For ICF2x4, the use of this enumerator is deprecated* [B)]*.*
	ROOFING: The covering is used to represent a roof.
	SLEEVING: The covering is used to isolate a distribution element from a space in which it is contained. *NOTE 16 For IFC2x4, the use of this enumerator is deprecated* [B)]*.*
	WRAPPING: The covering is used for wrapping particularly distribution elements using tape. *NOTE 17 For IFC2x4, the use of this enumerator is deprecated* [B)]*.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
CurtainWall	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Damper	BACKDRAFTDAMPER: Backdraft damper used to restrict the movement of air in one direction. *NOTE 18 Commonly operated by mechanical spring.*
	BALANCINGDAMPER: Damper used for purposes of manually balancing pressure differences. *NOTE 19 Commonly operated by mechanical adjustment.*
	BLASTDAMPER: Blast damper used to protects occupants and equipment against overpressures resultant of an explosion. *NOTE 20 Commonly operated by mechanical spring.*
	CONTROLDAMPER: Control damper used to modulate the flow of air by adjusting the position of the blades. *NOTE 21 Commonly operated by an actuator of a building automation system.*
	FIREDAMPER: Fire damper used to prevent the spread of fire for a specified duration. *NOTE 22 Commonly operated by fusable link that melts above a certain temperature.*
	FIRESMOKEDAMPER: Combination fire and smoke damper used to prevent the spread of fire and smoke. *NOTE 23 Commonly operated by a fusable link and a smoke detector.*
	FUMEHOODEXHAUST: Fume hood exhaust damper. *NOTE 24 Commonly operated by actuator.*
	GRAVITYDAMPER: Gravity damper closes from the force of gravity. *NOTE 25 Commonly operated by gravitational weight.*
	GRAVITYRELIEFDAMPER: Gravity-relief damper used to allow air to move upon a build-up of enough pressure to overcome the gravitational force exerted on the damper blades. *NOTE 26 Commonly operated by gravitational weight.*
	RELIEFDAMPER: Relief damper used to allow air to move upon a build-up of a specified pressure differential. *NOTE 27 Commonly operated by mechanical spring.*
	SMOKEDAMPER: Smoke damper used to prevent the spread of smoke. *NOTE 28 Commonly operated by a smoke detector of a building automation system.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
DiscreteAccessory	ANCHORPLATE: An accessory consisting of a steel plate, shear stud connector or welded-on rebar which is embedded into the surface of a concrete element so that other elements can be welded or bolted onto it later.
	BRACKET: An L-shaped or similarly shaped accessory attached in a corner between elements to hold them together or to carry a secondary element.
	SHOE: A column or beam shoe (beam hanger) used to support or secure an element.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
DistributionChamberElement	FORMEDDUCT: Space formed in the ground for the passage of pipes, cables, ducts.
	INSPECTIONCHAMBER: Chamber constructed on a drain, sewer or pipeline with a removable cover that permits visible inspection.
	INSPECTIONPIT: Recess or chamber formed to permit access for inspection of substructure and services.
	MANHOLE: Chamber constructed on a drain, sewer or pipeline with a removable cover that permits the entry of a person.
	METERCHAMBER: Chamber that houses a meter(s).
	SUMP: Recessed or small chamber into which liquid is drained to facilitate its collection for removal.
	TRENCH: Excavated chamber, the length of which typically exceeds the width.
	VALVECHAMBER: Chamber that houses a valve(s).
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Door	DOOR: A standard door usually within a wall opening, as a door panel in a curtain wall or a “free standing” door.
	GATE: A gate is a point of entry to a property usually within an opening in a fence or a “free standing” gate.
	TRAPDOOR: A special door that lies horizontally in a slab opening, often used for accessing a cellar or attic.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
DuctFitting	BEND: A fitting with typically two ports used to change the direction of flow between connected elements.
	CONNECTOR: Connector fitting typically used to join two ports together within a flow distribution system, e.g. a coupling used to join two duct segments.
	ENTRY: Entry fitting typically unconnected at one port and connected to a flow distribution system at the other, e.g. an outside air duct system intake opening.
	EXIT: Exit fitting typically unconnected at one port and connected to a flow distribution system at the other, e.g. an exhaust air discharge opening.
	JUNCTION: A fitting with typically more than two ports used to redistribute flow among the ports and/or to change the direction of flow between connected elements, e.g. tee, cross, wye.
	OBSTRUCTION: A fitting with typically two ports used to obstruct or restrict flow between the connected elements (e.g., screen, perforated plate, etc.).
	TRANSITION: A fitting with typically two ports having different shapes or sizes. *NOTE 29 May also be used to change the direction of flow between connected elements.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
DuctSegment	FLEXIBLESEGMENT: A flexible segment is a continuous non-linear segment of duct that can be deformed to change the direction of flow.
	RIGIDSEGMENT: A rigid segment is a continuous linear segment of duct that cannot be deformed.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
DuctSilencer	FLATOVAL: Flat, oval shaped duct silencer type.
	RECTANGULAR: Rectangular shaped duct silencer type.
	ROUND: Round duct silencer type.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ElectricAppliance	DISHWASHER: An appliance that has the primary function of washing dishes.
	ELECTRICCOOKER: An electrical appliance that has the primary function of cooking food, e.g. oven, hob, grill.
	FREESTANDINGELECTRICHEATER: An electrical appliance that is used occasionally to provide heat. *NOTE 30 A freestanding electric heater is a "plugged" appliance whose load may be removed from an electric circuit.*

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
ElectricAppliance (cont.)	FREESTANDINGFAN: An electrical appliance that is used occasionally to provide ventilation. *NOTE 31 A freestanding fan is a "plugged" appliance whose load may be removed from an electric circuit.*
	FREESTANDINGWATERCOOLER: A small, local electrical appliance for cooling water. *NOTE 32 A freestanding water cooler is a "plugged" appliance whose load may be removed from an electric circuit.*
	FREESTANDINGWATERHEATER: A small, local electrical appliance for heating water. *NOTE 33 A freestanding water heater is a "plugged" appliance whose load may be removed from an electric circuit.*
	FREEZER: An electrical appliance that has the primary function of storing food at temperatures below the freezing point of water.
	FRIDGE_FREEZER: An electrical appliance that combines the functions of a freezer and a refrigerator through the provision of separate compartments.
	KITCHENMACHINE: A specialized appliance used in commercial kitchens, e.g. a mixer.
	HANDDRYER: An electrical appliance that has the primary function of drying hands.
	MICROWAVE: An electrical appliance that has the primary function of cooking food using microwaves.
	PHOTOCOPIER: A machine that has the primary function of reproduction of printed matter.
	REFRIGERATOR: An electrical appliance that has the primary function of storing food at low temperature, but above the freezing point of water.
	TUMBLEDRYER: An electrical appliance that has the primary function of drying clothes.
	VENDINGMACHINE: An appliance that stores and vends goods including food, drink and goods of various types.
	WASHINGMACHINE: An appliance that has the primary function of washing clothes.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ElectricDistributionBoard	CONSUMERUNIT: A distribution point on the incoming electrical supply, typically in domestic premises, at which protective devices are located.
	DISTRIBUTIONBOARD: A distribution point at which connections are made for distribution of electrical circuits, usually through protective devices.
	MOTORCONTROLCENTRE: A distribution point at which starting and control devices for major plant items are located.
	SWITCHBOARD: A distribution point where switching devices are located.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
ElectricFlowStorageDevice	BATTERY: A device for storing energy in chemical form so that it can be released as electrical energy.
	CAPACITORBANK: A device that stores electrical energy when an external power supply is present by using the electrical property of capacitance.
	HARMONICFILTER: A device that constantly injects currents that precisely correspond to the harmonic components drawn by the load.
	UPS: A device that provides a time-limited alternative source of power supply in the event of main supply failure.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ElectricGenerator	CHP: Combined heat and power supply, used not only as a source of electric energy, but also a heating source for the building. *NOTE 34 It may be part of both an electrical system and a heating system.*
	ENGINEGENERATOR: Electrical generator with a fuel-driven engine, e.g. a diesel-driven emergency power supply.
	STANDALONE: Electrical generator which does not include its source of kinetic energy, i.e. a motor, engine, or turbine is modelled by a separate object.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ElectricMotor	DC: A motor using either generated or rectified DC power.
	INDUCTION: An alternating current motor in which the primary winding on one member (usually the stator) is connected to the power source and the secondary winding or a squirrel-cage secondary winding on the other member (usually the rotor), carries the induced current. *NOTE 35 There is no physical electrical connection to the secondary winding, its current is induced.*
	POLYPHASE: A two- or three-phase induction motor in which the windings, one for each phase, are evenly divided by the same number of electrical degrees.
	RELUCTANCESYNCHRONOUS: A synchronous motor with a special rotor design which directly lines the rotor up with the rotating magnetic field of the stator, allowing for no slip under load.
	SYNCHRONOUS: A motor that operates at a constant speed up to full load. *NOTE 36 The rotor speed is equal to the speed of the rotating magnetic field of the stator; there is no slip.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
ElectricTimeControl	MOTORCONTROLCENTRE: A distribution point at which starting and control devices for major plant items are located.
	CONSUMERUNIT: A distribution point on the incoming electrical supply, typically in domestic premises, at which protective devices are located.
	DISTRIBUTIONBOARD: A distribution point at which connections are made for distribution of electrical circuits, usually through protective devices.
	SWITCHBOARD: A distribution point at which switching devices are located.
	NOTDEFINED: Generic or undefined type.
	USERDEFINED: Other type.
Engine	EXTERNALCOMBUSTION: Combustion is external.
	INTERNALCOMBUSTION: Combustion is internal.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
EvaporativeCooler	DIRECTEVAPORATIVEAIRWASHER: Cools the air stream by evaporating water directly into the air stream using coolers with a spray-type air washer that consists of a chamber or casing containing spray nozzles and tanks for collecting spray water, and an eliminator section for removing entrained drops of water from the air.
	DIRECTEVAPORATIVEPACKAGEDROTARYAIRCOOLER: Cools the air stream by evaporating water directly into the air stream using coolers that wet and wash the evaporative pad by rotating it through a water bath.
	DIRECTEVAPORATIVERANDOMMEDIAAIRCOOLER: Cools the air stream by evaporating water directly into the air stream using coolers with evaporative pads, usually of aspen wood or plastic fibre/foam.
	DIRECTEVAPORATIVERIGIDMEDIAAIRCOOLER: Cools the air stream by evaporating water directly into the air stream using coolers with sheets of rigid, corrugated material as the wetted surface.
	DIRECTEVAPORATIVESLINGERSPACKAGEDAIRCOOLER: Cools the air stream by evaporating water directly into the air stream using coolers with a water slinger in an evaporative cooling section and a fan section.
	INDIRECTDIRECTCOMBINATION: Cools the air stream by evaporating water indirectly and without adding moisture into the air stream using a two-stage cooler with a first-stage indirect evaporative cooler and second-stage direct evaporative cooler.
	INDIRECTEVAPORATIVECOOLINGTOWERORCOILCOOLER: Cools the air stream by evaporating water indirectly and without adding moisture into the air stream using a combination of a cooling tower or other evaporative water cooler with a water-to-air heat exchanger coil and water circulating pump.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
EvaporativeCooler (cont.)	INDIRECTEVAPORATIVEPACKAGEAIRCOOLER: Cools the air stream by evaporating water indirectly and without adding moisture into the air stream. *NOTE 37 On one side of the heat exchanger, the secondary air stream is cooled by evaporation; on the other side of the heat exchanger, the primary air stream (conditioned air to be supplied to the room) is sensibly cooled by the heat exchanger surfaces.*
	INDIRECTEVAPORATIVEWETCOIL: Cools the air stream by evaporating water indirectly and without adding moisture into the air stream. *NOTE 38 Water is sprayed directly on the tubes of the heat exchanger where latent cooling takes place and the vaporization of the water on the outside of the heat exchanger tubes allows the simultaneous heat and mass transfer, which removes heat from the supply air on the tube side.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Evaporator	DIRECTEXPANSION: Direct-expansion device.
	DIRECTEXPANSIONBRAZEDPLATE: Direct-expansion evaporator where a refrigerant evaporates inside plates brazed or welded together to make up an assembly of separate channels.
	DIRECTEXPANSIONSHELLANDTUBE: Direct-expansion device where a refrigerant evaporates inside a series of baffles that channel the fluid throughout the shell side.
	DIRECTEXPANSIONTUBEINTUBE: Direct-expansion device where a refrigerant evaporates inside one or more pairs of coaxial tubes.
	FLOODEDSHELLANDTUBE: Evaporator in which refrigerant evaporates outside tubes.
	SHELLANDCOIL: Evaporator in which refrigerant evaporates inside a simple coiled tube immersed in the fluid to be cooled.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Fan	CENTRIFUGALAIRFOIL: Air flows through the impeller radially using blades that are airfoil shaped.
	CENTRIFUGALBACKWARDINCLINEDCURVED: Air flows through the impeller radially using blades that are backward curved.
	CENTRIFUGALFORWARDCURVED: Air flows through the impeller radially using blades that are forward curved.
	CENTRIFUGALRADIAL: Air flows through the impeller radially using blades that are uncurved or slightly forward curved.
	PROPELLORAXIAL: Air flows through the impeller axially and small hub-to-tip ratio impeller mounted in an orifice plate or inlet ring.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Fan (cont.)	TUBEAXIAL: Air flows through the impeller axially with reduced tip clearance and operating at higher tip speeds.
	VANEAXIAL: Air flows through the impeller axially with guide vanes and reduced running blade tip clearance.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Fastener	GLUE: A fastening connection where glue is used to join together elements.
	MORTAR: A composition of mineralic or other materials used to fill jointing gaps and possibly fulfilling a load carrying role.
	WELD: A weld seam between parts of metallic material or other suitable materials.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Filter	AIRPARTICLEFILTER: A filter used to remove particulates from air.
	COMPRESSEDAIRFILTER: A filter used to remove particulates from compressed air.
	ODORFILTER: A filter used to remove odours from air.
	OILFILTER: A filter used to remove particulates from oil.
	STRAINER: A filter used to remove particulates from a fluid.
	WATERFILTER: A filter used to remove particulates from water.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
FireSuppressionTerminal	BREECHINGINLET: Symmetrical pipe fitting that unites two or more inlets to form a single pipe [BS 6100 (all parts)]. *NOTE 39 A breeching inlet may be used on either a wet or dry riser; this is used by fire service personnel to allow fast connection of fire appliance hose reels. May also be used for foam.*
	FIREHYDRANT: Device, fitted to a pipe, through which a temporary supply of water may be provided [BS 6100 (all parts)]. *NOTE 40 Also known as a stand pipe.*
	HOSEREEL: A supporting framework on which a hose may be wound [BS 6100 (all parts)].
	SPRINKLER: Device for sprinkling water from a pipe under pressure over an area [BS 6100 (all parts)].
	SPRINKLERDEFLECTOR: Device attached to a sprinkler to deflect the water flow into a spread pattern to cover the required area.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
FlowInstrument	AMMETER: A measuring instrument used to measure the electric current in a circuit.
	FREQUENCYMETER: Device for measuring the repetitions per unit of time.
	PHASEANGLEMETER: Device that verifies phase angle for appropriate application, e.g. installation of equipment, load and power studies, synchronization of equipment.
	POWERFACTORMETER: Measures the electrical power circulating in any electric circuit.
	PRESSUREGAUGE: Device used for measuring the pressure of a gas or liquid.
	THERMOMETER: Device used for measuring the temperature of a gas or liquid.
	VOLTMETER_PEAK: A measuring instrument used to measure the peak electric potential between two points in a circuit.
	VOLTMETER_RMS: A measuring instrument used to measure the average electric potential between two points in a circuit.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
FlowMeter	ENERGYMETER: An electric meter or energy meter is a device that measures the amount of electrical energy supplied to, or produced by, a residence, business or machine.
	GASMETER: A device that measures the quantity of a gas or fuel.
	OILMETER: A device that measures the quantity of oil.
	WATERMETER: A device that measures the quantity of water.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Footing	CAISSON_FOUNDATION: A foundation construction element used in underwater construction.
	FOOTING_BEAM: Footing elements that are in bending and are supported clear of the ground. *NOTE 41 They normally span between piers, piles or pile caps. They are distinguished from beams in the building superstructure since they normally require a lower grade of finish. They are distinguished from STRIP_FOOTING since they are clear of the ground surface and hence require support to the lower face while the concrete is curing.*
	PAD_FOOTING: An element that transfers the load of a single column (possibly two) to the ground.
	PILE_CAP: An element that transfers the load from a column or group of columns to a pier or pile, or group of piers or piles.
	STRIP_FOOTING: A linear element that transfers the load into the ground from either a continuous element, e.g. a wall, or from a series of elements such as columns.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Footing (cont.)	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Furniture	BED: Furniture for sleeping.
	CHAIR: Furniture for seating a single person.
	DESK: Furniture with a countertop and optional drawers for a single person.
	FILECABINET: Furniture with sliding drawers for storing files.
	SHELF: Furniture for storing books or other items.
	SOFA: Furniture for seating multiple people.
	TABLE: Furniture with a countertop for multiple people.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
HeatExchanger	PLATE: Plate heat exchanger.
	SHELLANDTUBE: Shell and tube heat exchanger.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Humidifier	ADIABATICAIRWASHER: Water vapour is added into the airstream through adiabatic evaporation using an air washing element.
	ADIABATICATOMIZING: Water vapour is added into the airstream through adiabatic evaporation using an atomizing element.
	ADIABATICCOMPRESSEDAIRNOZZLE: Water vapour is added into the airstream through adiabatic evaporation using a compressed air nozzle.
	ADIABATICPAN: Water vapour is added into the airstream through adiabatic evaporation using a pan.
	ADIABATICRIGIDMEDIA: Water vapour is added into the airstream through adiabatic evaporation using a rigid media.
	ADIABATICULTRASONIC: Water vapour is added into the airstream through adiabatic evaporation using an ultrasonic element.
	ADIABATICWETTEDELEMENT: Water vapour is added into the airstream through adiabatic evaporation using a wetted element.
	ASSISTEDBUTANE: Water vapour is added into the airstream through water heated evaporation using a butane heater.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Humidifier (cont.)	ASSISTEDELECTRIC: Water vapour is added into the airstream through water heated evaporation using an electric heater.
	ASSISTEDNATURALGAS: Water vapour is added into the airstream through water heated evaporation using a natural gas heater.
	ASSISTEDPROPANE: Water vapour is added into the airstream through water heated evaporation using a propane heater.
	ASSISTEDSTEAM: Water vapour is added into the airstream through water heated evaporation using a steam heater.
	STEAMINJECTION: Water vapour is added into the airstream through direction steam injection.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Interceptor	CYCLONIC: Removes larger liquid drops or larger solid particles.
	GREASE: Chamber, on the line of a drain or discharge pipe, that prevents grease passing into a drainage system [BS 6100 (all parts)].
	OIL: One or more chambers arranged to prevent the ingress of oil to a drain or sewer that retains the oil for later removal [BS 6100 (all parts)].
	PETROL: Two or more chambers with inlet and outlet pipes arranged to allow petrol/gasoline, collected on the surface of water and drained into them, to evaporate through ventilating pipes.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
JunctionBox	POWER: Contains cables, outlets, and/or switches for electrical power.
	DATA: Contains cables, outlets, and/or switches for communications use.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Lamp	COMPACTFLUORESCENT: A fluorescent lamp having a compact form factor produced by shaping the tube.
	FLUORESCENT: A typically tubular discharge lamp in which most of the light is emitted by one or several layers of phosphors excited by ultraviolet radiation from the discharge.
	HALOGEN: An incandescent lamp in which a tungsten filament is sealed into a compact transport envelope filled with an inert gas and a small amount of halogen, e.g. iodine, bromine.
	HIGHPRESSUREMERCURY: A discharge lamp in which most of the light is emitted by exciting mercury at high pressure.
	HIGHPRESSURESODIUM: A discharge lamp in which most of the light is emitted by exciting sodium at high pressure.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
Lamp (cont.)	LED: A solid state lamp that uses light-emitting diodes as the source of light.
	METALHALIDE: A discharge lamp in which most of the light is emitted by exciting a metal halide.
	OLED: A solid state lamp that uses light-emitting diodes as the source of light whose emissive, electroluminescent layer is composed of a film of organic compounds.
	TUNGSTENFILAMENT: A lamp that emits light by passing an electrical current through a tungsten wire filament in a near vacuum.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
LightFixture	DIRECTIONSOURCE: A light fixture that is considered to have a length or surface area from which it emits light in a direction, e.g. light fixture containing one or more fluorescent lamps.
	POINTSOURCE: A light fixture that is considered to have negligible area and that emits light with approximately equal intensity in all directions, e.g. light fixture containing tungsten, halogen or similar bulb.
	SECURITYLIGHTING: A light fixture having specific purpose of directing occupants in an emergency, e.g. an illuminated exit sign, emergency flood light.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
MechanicalFastener	ANCHORBOLT: A special bolt which is anchored into concrete, stone, or brickwork.
	BOLT: A threaded cylindrical rod that engages with a similarly threaded hole in a nut, or any other part, to form a fastener. *NOTE 42 The mechanical fastener often includes one or more washers and one or more nuts.*
	DOWEL: A cylindrical rod that is driven into holes of the connected pieces.
	NAIL: A thin, pointed piece of metal that is hammered into materials as a fastener.
	NAILPLATE: A piece of sheet metal with punched points that overlaps the connected pieces and is pressed into their material.
	RIVET: A fastening part having a head at one end and the other end is hammered flat after being passed through holes in the pieces that are fastened together.
	SCREW: A fastener with a tapered threaded shank and a slotted head.
	SHEARCONNECTOR: A ring connector that is accepted by ring keyways in the connected pieces; or a toothed circular or square connector that is pressed into the connected pieces.
	STAPLE: A double pointed piece of metal that is hammered into materials as a fastener.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
MechanicalFastener (cont.)	STUDSHEARCONNECTOR: Stud shear connectors are cylindrical fastening parts with a head on one side; on the other side they are welded on steel members for the use in composite steel and concrete structures.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
MedicalDevice	AIRSTATION: Device that provides purified medical air; composed of an air compressor and air treatment line.
	FEEDERUNIT: Device that feeds air to an oxygen generator; composed of an air compressor, air treatment line and an air receiver.
	OXYGENGENERATOR: Device that generates oxygen from air.
	OXYGENPLANT: Device that combines a feed air unit, oxygen generator, and backup oxygen cylinders.
	VACUUMSTATION: Device that provides suction; composed of a vacuum pump and bacterial filtration line.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Member	BRACE: A linear element (usually sloped) often used for bracing a girder or truss.
	CHORD: Upper or lower longitudinal member of a truss, used horizontally or sloped.
	COLLAR: A linear element (usually used horizontally) within a roof structure to connect rafters and posts.
	MEMBER: A linear element within a girder or truss with no further meaning.
	MULLION: A linear element within a curtain wall system that connects two (or more) panels.
	PLATE: A linear continuous horizontal element in wall framing, e.g. head piece, sole plate. *NOTE 43 The head piece or sole plate is not to be mixed up with planar elements, e.g. sheets and panels, which are handled as IfcPlate (and IfcPlateType).*
	POST: A linear member (usually used vertically) within a roof structure to support purlins.
	PURLIN: A linear element (usually used horizontally) within a roof structure to support rafters
	RAFTER: A linear elements used to support roof slabs or roof covering, usually used with slope.
	STRINGER: A linear element used to support stair or ramp flights, usually used with slope.
	STRUT: A linear element often used within a girder or truss.
	STUD: A vertical element in wall framing.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
MotorConnection	BELTDRIVE: An indirect connection made through the medium of a shaped, flexible continuous loop.
	COUPLING: An indirect connection made through the medium of the viscosity of a fluid.
	DIRECTDRIVE: A direct, physical connection made between the motor and the driven device.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Outlet	AUDIOVISUALOUTLET: An outlet used for an audio or visual device.
	COMMUNICATIONSOUTLET: An outlet used for connecting communications equipment.
	DATAOUTLET: An outlet used for connecting data communications equipment.
	POWEROUTLET: An outlet used for connecting electrical devices requiring power.
	TELEPHONEOUTLET: Outlet used for connecting telephone communications equipment.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Pile	BORED: A bore pile.
	COHESION: A cohesion pile.
	DRIVEN: A rammed, vibrated, or driven pile.
	FRICTION: A friction pile.
	JETGROUTING: An injected pile-like construction.
	SUPPORT: A support pile.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
PipeFitting	BEND: A fitting with typically two ports used to change the direction of flow between connected elements.
	CONNECTOR: Connector fitting typically used to join two ports together within a flow distribution system, e.g. coupling used to join two pipe segments.
	ENTRY: Entry fitting typically unconnected at one port and connected to a flow distribution system at the other, e.g. breeching inlet.
	EXIT: Exit fitting typically unconnected at one port and connected to a flow distribution system at the other, e.g. hose bib.
	JUNCTION: A fitting with typically more than two ports used to redistribute flow among the ports and/or to change the direction of flow between connected elements, e.g. tee, cross, wye.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
PipeFitting (cont.)	OBSTRUCTION: A fitting with typically two ports used to obstruct or restrict flow between connected elements, e.g. screen, perforated plate.
	TRANSITION: A fitting with typically two ports of different shapes or sizes that can be used to change the direction of flow between connected elements.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
PipeSegment	CULVERT: A covered channel or large pipe that forms a watercourse below ground level, usually under a road or railway.
	FLEXIBLESEGMENT: A flexible segment is a continuous non-linear segment of pipe that can be deformed to change the direction of flow.
	GUTTER: A gutter segment is a continuous open-channel segment of pipe.
	RIGIDSEGMENT: A rigid segment is a continuous linear segment of pipe that cannot be deformed.
	SPOOL: A type of rigid segment that is typically shorter and used for providing connectivity within a piping network.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Plate	CURTAIN_PANEL: A planar element within a curtain wall, often consisting of a frame with fixed glazing.
	SHEET: A planar, flat and thin element; comes usually as a metal sheet and is often used as an additional part within an assembly.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ProtectiveDevice	CIRCUITBREAKER: A mechanical switching device capable of making, carrying and breaking current under normal circuit conditions, and also making, carrying for a specified time and breaking current under specified abnormal circuit conditions such as those of short circuit.
	EARTHINGSWITCH: A safety device used to open or close a circuit when there is no current. *NOTE 44 It is used to isolate a part of a circuit, a machine, a part of an overhead line or an underground line so that maintenance can be safely conducted.*
	EARTHLEAKAGECIRCUITBREAKER: A device that opens, closes or isolates a circuit and has short circuit protection, but no overload protection. *NOTE 45 It attempts to break the circuit when there is a leakage of current from phase to earth by measuring voltage on the earth conductor.*

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	Predefined type and description[B)]
ProtectiveDevice (cont.)	FUSEDISCONNECTOR: A device that electrically opens the circuit after a period of prolonged, abnormal current flow.
	RESIDUALCURRENTCIRCUITBREAKER: A device that opens, closes, or isolates a circuit and has short circuit and overload protection. *NOTE 46 It attempts to break the circuit when there is a difference in current between any two phases. It may be referred to as a "ground fault interrupter (GFI)" or a "ground fault circuit interrupter (GFCI)".*
	RESIDUALCURRENTSWITCH: A device that opens, closes or isolates a circuit and has no short circuit or overload protection. *NOTE 47 It may also be identified as a "ground fault switch".*
	VARISTOR: A high voltage surge protection device.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ProtectiveDeviceTrippingUnit	ELECTROMAGNETIC: A tripping unit activated by electromagnetic action.
	ELECTRONIC: A tripping unit activated by electronic action.
	RESIDUALCURRENT: A tripping unit activated by residual current detection.
	THERMAL: A tripping unit activated by thermal action.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Pump	CIRCULATOR: A circulator pipe is a generic low-pressure, low-capacity pump. *NOTE 48 It may have a wet rotor and may be driven by a flexible-coupled motor.*
	ENDSUCTION: An end suction pump, when mounted horizontally, has a single horizontal inlet on the impeller suction side and a vertical discharge. *NOTE 49 It may have a direct or close-coupled motor.*
	SPLITCASE: A split case pump, when mounted horizontally, has an inlet and outlet on each side of the impeller. *NOTE 50 The impeller may be accessed by removing the front of the impeller casing. It may have a direct or close-coupled motor.*
	SUBMERSIBLEPUMP: A pump designed to be immersed in fluid, typically a collection tank.
	SUMPPUMP: A pump designed to sit above a collection tank with a suction inlet extending into the tank.
	VERTICALINLINE: A vertical inline pump has the pump and motor close-coupled on the pump casing. The pump depends on the connected, horizontal piping for support, with the suction and discharge along the piping axis.
	VERTICALTURBINE: A vertical turbine pump has a motor mounted vertically on the pump casing for either wet-pit sump mounting or dry-well mounting.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	Predefined type and description [B]
Pump (cont.)	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Railing	BALUSTRADE: Similar to the definitions of a guardrail except the location is at the edge of a floor, rather then a stair or ramp, e.g. balustrades at roof-tops or balconies.
	GUARDRAIL: A type of railing designed to guard human occupants from falling off a stair, ramp or landing where there is a vertical drop at the edge, e.g. floors, landings.
	HANDRAIL: A type of railing designed to serve as an optional structural support for loads applied by human occupants (at hand height). *NOTE 51 It is generally located adjacent to ramps and stairs, mounted on the floor or wall.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Ramp	HALF_TURN_RAMP: A ramp making a 180° turn, consisting of two straight flights connected by a half-space landing. *NOTE 52 The orientation of the turn is determined by the walking line.*
	QUARTER_TURN_RAMP: A ramp making a 90° turn, consisting of two straight flights connected by a quarter-space landing. *NOTE 53 The direction of the turn is determined by the walking line.*
	SPIRAL_RAMP: A ramp constructed around a circular or elliptical well without newels and landings.
	STRAIGHT_RUN_RAMP: A ramp, which is a sloping floor, walk, or roadway, connecting two levels, consisting of one straight flight without turns or winders.
	TWO_QUARTER_TURN_RAMP: A ramp making a 180° turn, consisting of three straight flights connected by two quarter-space landings. *NOTE 54 The direction of the turn is determined by the walking line.*
	TWO_STRAIGHT_RUN_RAMP: A straight ramp consisting of two straight flights without turns but with one landing.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
RampFlight	SPIRAL: A ramp flight with a circular or elliptical walking line.
	STRAIGHT: A ramp flight with a straight walking line.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	**Predefined type and description**[B)]
ReinforcingElement	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Roof	BARREL_ROOF: A roof or ceiling with a semi-cylindrical form.
	BUTTERFLY_ROOF: A roof having two slopes, each descending inward from the eaves.
	DOME_ROOF: A hemispherical hip roof.
	FLAT_ROOF: A roof having no slope, or one with a slight pitch for draining rainwater.
	FREEFORM: Free form roof.
	GABLE_ROOF: A roof sloping downwards in two parts from a central ridge so as to form a gable at each end.
	GAMBREL_ROOF: A ridged roof divided on each side into a shallower slope above a steeper one.
	HIP_ROOF: A roof with sloping ends and sides meeting at an inclined projecting angle.
	HIPPED_GABLE_ROOF: A roof with a hipped end truncating a gable.
	MANSARD_ROOF: A roof having on each side a steeper lower part and a shallower upper part.
	PAVILION_ROOF: A pyramidal hip roof.
	RAINBOW_ROOF: A gable roof with in the form of a broad gothic arch, with gently sloping convex surfaces.
	SHED_ROOF: A roof having a single slope.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
SanitaryTerminal	BATH: Sanitary appliance for immersion of the human body or parts of it.
	BIDET: Waste water appliance for washing the excretory organs while sitting astride the bowl.
	CISTERN: A water storage appliance attached to a sanitary terminal that is fitted with a device, operated automatically or by the user, that discharges water to cleanse a water closet (toilet) pan, urinal or slop hopper.
	SANITARYFOUNTAIN: A sanitary terminal that provides a low pressure jet of water for a specific purpose.
	SHOWER: Installation or waste water appliance that emits a spray of water to wash the human body.
	SINK: Waste water appliance for receiving, retaining or disposing of domestic, culinary, laboratory or industrial process liquids.
	TOILETPAN: Soil appliance for the disposal of excrement.
	URINAL: Soil appliance that receives urine and directs it to a waste outlet [BS 6100 (all parts)].
	WASHHANDBASIN: Waste water appliance for washing the upper parts of the body.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
SanitaryTerminal (cont.)	WCSEAT: [Deprecated] Hinged seat that fits on the top of a water closet (WC) pan.
	USERDEFINED: Other type
	NOTDEFINED: Generic or undefined type
Sensor	CONDUCTANCESENSOR: A device that senses or detects electrical conductance.
	CONTACTSENSOR: A device that senses or detects contact, e.g. for detecting if a door is closed.
	FIRESENSOR: A device that senses or detects fire.
	FLOWSENSOR: A device that senses or detects flow in a fluid.
	GASSENSOR: A device that senses or detects gas concentration.
	HEATSENSOR: A device that senses or detects or detects heat.
	HUMIDITYSENSOR: A device that senses or detects humidity.
	IONCONCENTRATIONSENSOR: A device that senses or detects ion concentration, e.g. for water hardness.
	LEVELSENSOR: A device that senses or detects fill level, e.g. for a tank.
	LIGHTSENSOR: A device that senses or detects light.
	MOISTURESENSOR: A device that senses or detects moisture.
	MOVEMENTSENSOR: A device that senses or detects movement.
	PHSENSOR: A device that senses or detects acidity.
	PRESSURESENSOR: A device that senses or detects pressure.
	RADIATIONSENSOR: A device that senses or detects electromagnetic radiation.
	RADIOACTIVITYSENSOR: A device that senses or detects atomic decay.
	SMOKESENSOR: A device that senses or detects smoke.
	SOUNDSENSOR: A device that senses or detects sound.
	TEMPERATURESENSOR: A device that senses or detects temperature.
	WINDSENSOR: A device that senses or detects airflow speed and direction.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
ShadingDevice	JALOUSIE: A blind or shutter made with horizontal slats that can be adjusted to admit light and air, but excludes rain and sun rays.
	SHUTTER: A solid or louvered movable cover for a window.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	Predefined type and description [B]
ShadingDevice (cont.)	AWNING: A roof-like shelter of canvas or other material extending over a doorway, from the top of a window, over a deck, etc. to provide protection, e.g. from the sun.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Slab	BASESLAB: The slab is used to represent a floor slab against the ground (and thereby is a part of the foundation). *NOTE 55 Also known as mat foundation. IFC2x3 CHANGE new enumerator added [B].*
	FLOOR: The slab is used to represent a floor slab.
	LANDING: The slab is used to represent a landing within a stair or ramp.
	ROOF: The slab is used to represent a roof slab, either flat or sloped.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
SolarDevice	SOLARCOLLECTOR: A device that converts solar radiation into thermal energy, e.g. heating water.
	SOLARPANEL: A device that converts solar radiation into electric current.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
SpaceHeater	CONVECTOR: A heat-distributing unit that operates with gravity-circulated air.
	RADIATOR: A heat-distributing unit that operates with thermal radiation.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
StackTerminal	BIRDCAGE: Guard cage, typically wire mesh, at the top of the stack preventing access by birds.
	COWL: A cowling placed at the top of a stack to prevent downdraft.
	RAINWATERHOPPER: A box placed at the top of a rainwater downpipe to catch rainwater from guttering.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Stair	CURVED_RUN_STAIR: A stair extending from one level to another without turns or winders, consisting of one curved flight.
	DOUBLE_RETURN_STAIR: A stair having one straight flight to a wide quarter-space landing and two side flights from that landing into opposite directions making a 90° turn. *NOTE 56 The direction of traffic is determined by the walking line.*

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Stair (cont.)	HALF_TURN_STAIR: A stair making a 180° turn consisting of two straight flights connected by a half-space landing. *NOTE 57 The orientation of the turn is determined by the walking line.*
	HALF_WINDING_STAIR: A stair consisting of one flight with one half winder, which makes a 180° turn. *NOTE 58 The orientation of the turn is determined by the walking line.*
	QUARTER_TURN_STAIR: A stair making a 90° turn consisting of two straight flights connected by a quarter-space landing. *NOTE 59 The direction of the turn is determined by the walking line.*
	QUARTER_WINDING_STAIR: A stair consisting of one flight with a quarter winder that makes a 90° turn. *NOTE 60 The direction of the turn is determined by the walking line.*
	SPIRAL_STAIR: A stair constructed with winders around a circular newel often without landings. *NOTE 61 Depending on the outer boundary, it can be either a circular, elliptical or rectangular spiral stair. The orientation of the winding stairs is determined by the walking line.*
	STRAIGHT_RUN_STAIR: A stair extending from one level to another without turns or winders, consisting of one straight flight.
	THREE_QUARTER_TURN_STAIR: A stair making a 270° turn consisting of four straight flights connected by three quarter-space landings. *NOTE 62 The direction of the turns is determined by the walking line.*
	THREE_QUARTER_WINDING_STAIR: A stair making a 270° turn consisting of one flight with three quarter winders, which makes a 90° turn. *NOTE 63 The direction of the turns is determined by the walking line.*
	TWO_CURVED_RUN_STAIR: A curved stair consisting of two curved flights without turns, but one landing.
	TWO_QUARTER_TURN_STAIR: A stair making a 180° turn consisting of three straight flights connected by two quarter-space landings. *NOTE 64 The direction of the turns is determined by the walking line.*
	TWO_QUARTER_WINDING_STAIR: A stair consisting of one flight with two quarter winders, which makes a 90° turn; the stair makes a 180° turn. *NOTE 65 The direction of the turns is determined by the walking line.*
	TWO_STRAIGHT_RUN_STAIR: A straight stair consisting of two straight flights without turns, but one landing.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	Predefined type and description[B)]
StairFlight	CURVED: A stair flight with a curved walking line.
	FREEFORM: A stair flight with a free form walking line (and outer boundaries).
	SPIRAL: A stair flight with a circular or elliptical walking line.
	STRAIGHT: A stair flight with a straight walking line.
	WINDER: A stair flight with a straight walking line.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
SwitchingDevice	CONTACTOR: An electrical device used to control the flow of power in a circuit on or off.
	DIMMERSWITCH: A dimmer switch has variable positions and can adjust electrical power or other settings (according to the switched port type).
	EMERGENCYSTOP: An emergency stop device acts to remove as quickly as possible any danger that might have arisen unexpectedly.
	KEYPAD: A set of buttons or switches, each potentially applicable to a different device.
	MOMENTARYSWITCH: A momentary switch has no position and can trigger an action to occur.
	SELECTORSWITCH: A selector switch has multiple positions and can change the source or level of power or other setting (according to the switched port type).
	STARTER: A starter is a switch which, in the closed position, controls the application of power to an electrical device.
	SWITCHDISCONNECTOR: A switch disconnector is a switch which, in the open position, satisfies the isolating requirements specified for a disconnector.
	TOGGLESWITCH: A toggle switch has two positions and can enable or isolate electrical power or other setting (according to the switched port type).
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
SystemFurnitureElement	PANEL: Vertical panel used to divide work spaces.
	WORKSURFACE: Workstation countertop.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Tank	BASIN: An arbitrary open tank type.
	BREAKPRESSURE: An open container that breaks the hydraulic pressure in a distribution system, typically located between the fluid reservoir and the fluid supply points. *NOTE 66 A typical break pressure tank allows the flow to discharge into the atmosphere, thereby reducing its hydrostatic pressure to zero.*
	EXPANSION: A closed container used in a closed fluid distribution system to mitigate the effects of thermal expansion or water hammer, e.g. when connected to the primary circuit of a hot water system to accommodate the increase in volume of the water when it is heated. *NOTE 67 The tank is typically constructed with a diaphragm dividing the tank into two sections, with fluid on one side of the diaphragm and air on the other.*
	FEEDANDEXPANSION: An open tank that is used for both storage and thermal expansion. *NOTE 68 For example, a tank used to store make-up water at ambient pressure for supply to a hot water system, simultaneously accommodating increases in volume of the water when heated.*
	PRESSUREVESSEL: A closed container used for storing fluids or gases at a pressure different from the ambient pressure. *NOTE 69 A pressure vessel is typically rated by an authority having jurisdiction for the operational pressure.*
	STORAGE: An open or closed container used for storing a fluid at ambient pressure from which it can be supplied to the fluid distribution system, e.g. potable water storage tanks, fuel storage tanks.
	VESSEL: An arbitrary closed tank type.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Transformer	CURRENT: A transformer that changes the current between circuits.
	FREQUENCY: A transformer that changes the frequency between circuits.
	INVERTER: A transformer that converts from direct current (DC) to alternating current (AC).
	RECTIFIER: A transformer that converts from alternating current (AC) to direct current (DC).
	VOLTAGE: A transformer that changes the voltage between circuits.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A)]	Predefined type and description[B)]
TransportElement	CRANEWAY: A crane way system, normally including the crane rails, fasteners and the crane. *NOTE 70 It is primarily used to move heavy goods in a factory or other industry buildings.*
	ELEVATOR: Elevator or lift being a transport device to move people or goods vertically.
	ESCALATOR: Escalator being a transport device to move people; consisting of individual linked steps that move up and down on tracks while keeping the threads horizontal.
	LIFTINGGEAR: A device used for lifting or lowering heavy goods. *NOTE 71 It may be manually operated or electrically or pneumatically driven.*
	MOVINGWALKWAY: Moving walkway being a transport device to move people horizontally or on an incline. *NOTE 72 It is a slow conveyor belt that transports people.*
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
TubeBundle	FINNED: Finned tube bundle type.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
UnitaryControlElement	ALARMPANEL: A control element at which alarms are annunciated.
	CONTROLPANEL: A control element at which devices that control or monitor the operation of a site, building or part of a building are located.
	GASDETECTORPANEL: A control element at which the detection of gas is annunciated.
	HUMIDISTAT: A control element that senses and regulates the humidity of a system or space so that the humidity is maintained near a desired set point.
	INDICATORPANEL: A control element at which equipment operational status, condition, safety state or other required parameters are indicated.
	MIMICPANEL: A control element at which information that is available elsewhere is repeated or "mimicked".
	THERMOSTAT: A control element that senses and regulates the temperature of an element, system or space so that the temperature is maintained near a desired set point.
	WEATHERSTATION: A control element that senses multiple climate properties such as temperature, humidity, pressure, wind, and rain.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
UnitaryEquipment	AIRCONDITIONINGUNIT: A unitary packaged air-conditioning unit typically used in residential or light commercial applications.
	AIRHANDLER: A unitary air handling unit typically containing a fan, economizer, and coils.
	DEHUMIDIFIER: A unitary packaged dehumidification unit. *NOTE 73 Units supporting multiple modes (dehumidification, cooling, and/or heating) may use AIRCONDITIONINGUNIT.*
	ROOFTOPUNIT: A packaged assembly that is either field-erected or manufactured atop the roof of a large residential or commercial building and acts as a unitary component.
	SPLITSYSTEM: A system which separates the compressor from the evaporator, but acts as a unitary component typically within residential or light commercial applications.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Valve	AIRRELEASE: Valve used to release air from a pipe or fitting.
	ANTIVACUUM: Valve that opens to admit air if the pressure falls below atmospheric pressure [BS 6100 (all parts)].
	CHANGEOVER: Valve that enables flow to be switched between pipelines (3 or 4 port).
	CHECK: Valve that permits water to flow in one direction only and is enclosed when there is no flow (2 port).
	COMMISSIONING: Valve used to facilitate commissioning of a system (2 port).
	DIVERTING: Valve that enables flow to be diverted from one branch of a pipeline to another (3 port).
	DOUBLECHECK: An assembly that incorporates two valves used to prevent backflow [BS 6100 (all parts)].
	DOUBLEREGULATING: Valve used to facilitate regulation of fluid flow in a system.
	DRAWOFFCOCK: Valve used to remove fluid from a piping system.
	FAUCET: Faucet valve used as a flow discharge.
	FLUSHING: Valve that flushes a predetermined quantity of water to cleanse a toilet, urinal, etc.
	GASCOCK: Valve that is used for controlling the flow of gas.
	GASTAP: Gas tap typically used for venting or discharging gas from a system.
	ISOLATING: Valve that closes off flow in a pipeline.
	MIXING: Valve that enables flow from two branches of a pipeline to be mixed together (3 port).
	PRESSUREREDUCING: Valve that reduces the pressure of fluid immediately downstream in a pipeline to a preselected value or by a predetermined ratio.

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
Valve (cont.)	PRESSURERELIEF: Spring or weight loaded valve that automatically discharges to a safe place that has built up to excessive pressure in pipes or fittings.
	REGULATING: Valve used to facilitate regulation of fluid flow in a system.
	SAFETYCUTOFF: Valve that closes under the action of a safety mechanism, e.g. drop weight, solenoid.
	STEAMTRAP: Valve that restricts flow of steam while allowing condensate to pass through.
	STOPCOCK: Isolating valve used on a domestic water service.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
VibrationIsolator	COMPRESSION: Compression type vibration isolator.
	SPRING: Spring type vibration isolator.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Wall	ELEMENTEDWALL: A stud wall framed with studs and faced with sheatings, sidings, wallboard or plasterwork.
	MOVABLE: A moveable wall that is either movable, e.g. a folding wall or a sliding wall, or can be easily removed as a partitioning or mounting wall. *NOTE 74 Movable walls do not normally define space boundaries and often belong to the furnishing system.*
	PLUMBINGWALL: A pier, enclosure or encasement, normally used to enclose plumbing in sanitary rooms.
	POLYGONAL: A polygonal wall, extruded vertically, where the wall thickness varies along the wall path.
	SHEAR: A wall having a non-rectangular cross section along the wall path. *NOTE 75 This potentially misleading term does not impose a resistance against shear forces, but a particular shape.*
	STANDARD: A standard wall extruded vertically with a constant thickness along the wall path.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
WasteTerminal	FLOORTRAP: Pipe fitting, set into the floor, that retains liquid to prevent the passage of foul air.
	FLOOORWASTE: Pipe fitting, set into the floor, that collects waste water and discharges it to a separate trap.
	GULLYSUMP: Pipe fitting or assembly of fittings to receive surface water or waste water; fitted with a grating or sealed cover.
	GULLYTRAP: Pipe fitting or assembly of fittings to receive surface water or waste water; fitted with a grating or sealed cover and discharging through a trap [BS 6100 (all parts)].

Table D.1 **IFC type (library) object and predefined types with descriptions** *(continued)*

Library object (IFC*Type)[A]	**Predefined type and description**[B]
WasteTerminal (cont.)	ROOFDRAIN: Pipe fitting, set into the roof, that collects rainwater for discharge into the rainwater system.
	WASTEDISPOSALUNIT: Electrically operated device that reduces kitchen or other waste into fragments small enough to be flushed into a drainage system.
	WASTETRAP: Pipe fitting, set adjacent to a sanitary terminal, that retains liquid to prevent the passage of foul air.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.
Window	LIGHTDOME: A special window that lies horizontally in a roof slab opening.
	SKYLIGHT: A window within a sloped building element, usually a roof slab.
	WINDOW: A standard window usually within a wall opening, as a window panel in a curtain wall, or a "free standing" window.
	USERDEFINED: Other type.
	NOTDEFINED: Generic or undefined type.

[A] At IFC2x3 the occurrence object may be named at a more general level of specialisation than the type (library) object. At IFC2x4, the occurrence object is named directly from the type (library) object by dropping "Type". At IFC2x3 "Door" and "Window" use the suffix "Style" instead of "Type".[B] If no applicable predefined type is found then USERDEFINED may be given, and specific type description may be provided in the element type attribute.If the object is more generic than any available predefined type, then NOTDEFINED may be given.

NOTE 76 IFC objects are named without spaces, using camel case in IFCXML and using upper case in. Predefined types are named without spaces and in lower case in IFCXML and in upper case in IFC.

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