

# PRODBIM Overview

*Act of digitalization of construction products  
Outlines of CEN TC 442 developments & ISO TC 59  
BIM & Digitalization*



**THIBAUD DE LOYNES**  
Prodbim Project Director  
PRODBIM + 33 6 30 14 45 50  
t.deloynes@prod-bim.com  
[www.prod-bim.com](http://www.prod-bim.com)



Overview on Building Information Modelling (BIM) & recent developments in construction Product digitalization & standardization.

The necessity to be INTERCONNECTED.

PRODBIM, as subsidiary of Eurovent Services Company and in association with REHVA, is participating in CEN TC 442 & BuildingSMART working groups, and is compiling a summary of what is necessary to understand in the digitalization of our HVAC-R industry. Interconnecting dictionaries is the first step!

## State of the art:

Today, we have all understood that the construction industry is moving towards digital building twin and BIM models. Indeed, the Computer-Aided Design software have finally evolved in 3D like their pairs in automotive or aeronautics sectors many years ago. This impacts the whole value chain of the construction: from design, simulation, installation, and maintenance and it concerns all the actors: AEC (Architect/Engineering/Contractors) but also in the near future, the facility management and the final users, i.e. building owners.

In parallel, the web is accelerating the broadcasting of product catalogues along with the resellers.

Indeed, the information of our manufactured products will be integrated in the 3D models and will need to be exchanged in a digital format with the different users. Therefore, the traditional product documentation needs to be structured by product data. Many libraries

are nurturing to propose local product databases and the web catalogues are proposing our manufacturers products online for product selection.

The main question then arises: how the product information will be manageable in this digital evolution. The standardization works carried out by ISO TC 59 & CEN TC 442 on our European perimeter are keys to address this main evolution, but it is to ourselves to set the common framework for our HVAC-R industry.

## The digital standards landscape

Let's try to see clearly in these digital standards and regulations.

First, we have the Construction Products Regulation which sets harmonised rules on how to express the performance of construction product and CEN standards ruling products compliances (CE marking, DoP, method of measurement & testing...).

Secondly, we have new ISO & CEN standards to organize the information for the construction sector which embeds the building product information. The corresponding working groups and technical committees and projects are part of the following TC s:



The ecosystem of standards working groups in digital buildings can also be represented as in Figure 1.

**The building digitalization and the BIM**

To explain easily what the construction and real estate sector is facing in the actual digitalization process is what happened in the automotive industry with the CAD drawing revolution.

The Building information modelling (or management), are the same faces of the digital transformation of the building sector: the CAD software can draw in 3D where the drawing contains objects with the geometry and information on the equipment and the building, and not any more vectors like Autocad 2D. Thus these objects become a class in Information Technology language, with data.

The Building information modelling, or management is a collaborative process where the different actors of the AEC and building sector industry can share simultaneously a 3D model and information within, as shown in the diagrams. This is a change and also in the lifecycle of the product in a building project.

Software editors gathered years ago to solve the question: how to put the information to be interoperable and machine-readable. They used comparable industrial IT methodology standards like EXPRESS-STEP and the Industry Foundation Class (IFC) was born!

In order for two software to read exchange information, we need a triangle of information:

1. a common terminology
2. a format
3. an exchange specification independent from native software languages

and an international association to coordinate these new ISO standards and the BIM development: here is the openBIM!

To explain the IFC structure, a class of an IFC object has been created to store the information of the project and elements based on EXPRESS or XML the common used web language. We are now in the IFC version 4, after the IFC2\*3.

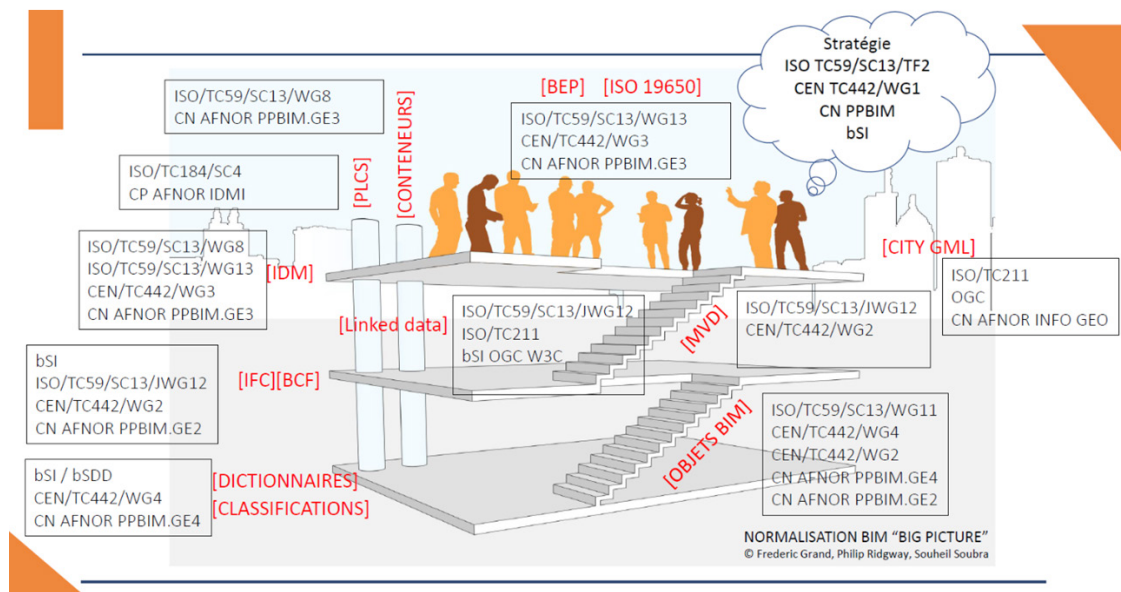


Figure 1. BIM Standardisation BIG PICTURE. (source AFNOR PPBIM)

Example of IFC structure, classes and relation extracted from BuildingSMART (Figure 5a,b,c,d).

In principle, a product is designed in a calculation software or 3D building model or pulled out of a BIM object library, which generates a compatible IFC file with geometry and parameters of the buildings and the different layers and objects. Levels of Details and Information are defined following the phase of the project and additional dimensions of information can be added (geometry, planning, cost, energy, maintenance...). The parameters of the object are translated in properties in IFC fields. A property is a feature of an object which can be generic with no brand name or a catalogue product in our case.

See example of the product integration in the BIM value chain: the manufacturer sends to the designer software its catalogue products or the designer selects in a library of regulatory products the required compliant

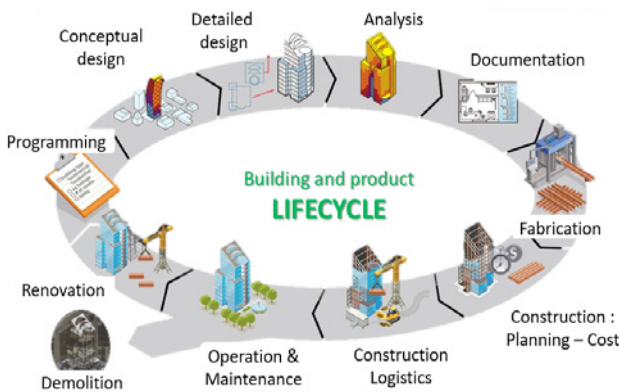


Figure 2. BIM lifecycle

products for its building project or thermal calculation. Then the objects and libraries are connected to the BIM CAD modellers with interfaces (APIs or plug-ins).

However, the critical task for each actor is to receive a product information to be able to map the information between the request and the response: i.e. If no common terminology is defined, how can our users and our manufacturers communicate?

Same for the product classifications, how to send product information to the local classification or required classification? Regulatory, standard, code, local requirements like thermal regulation, ETIM, Omniclass, Uniformat... and so many classifications coexist today but how to link my product data information with all?

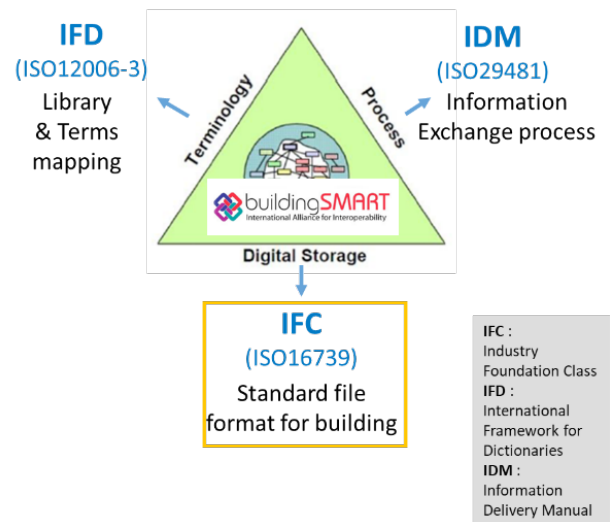


Figure 4. BIM standards diagram.

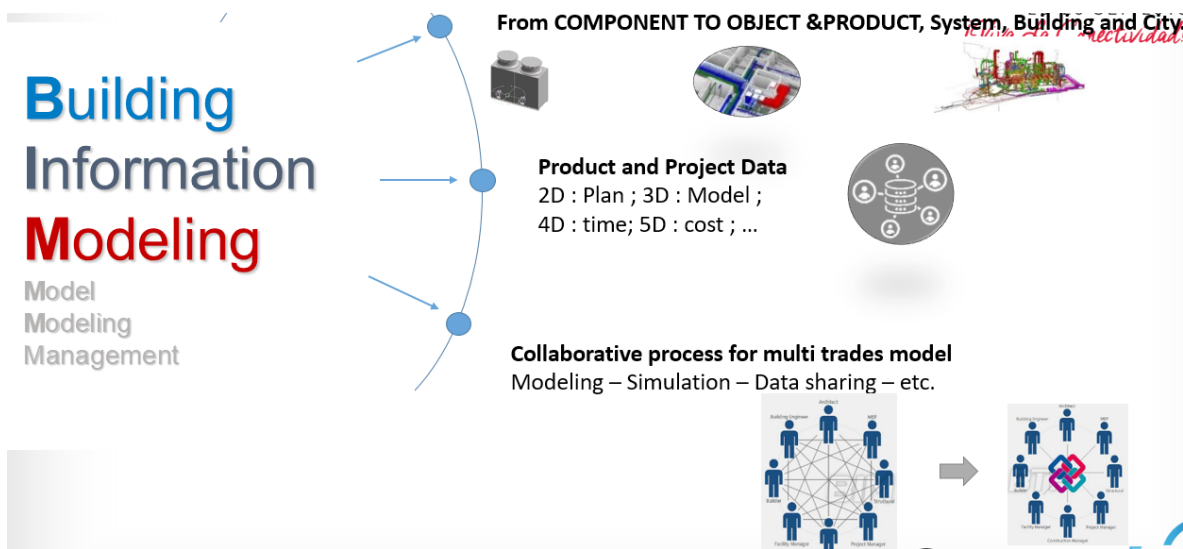


Figure 3. BIM diagram.

For the specific performance data, if we do not have the same definition of the product property, how a software can select a product list based on a performance or certification?

At last, if I have my official local dictionary of products in my country, how to link it with my other market in the neighbour country with the other local language dictionary?

## IFC Structure

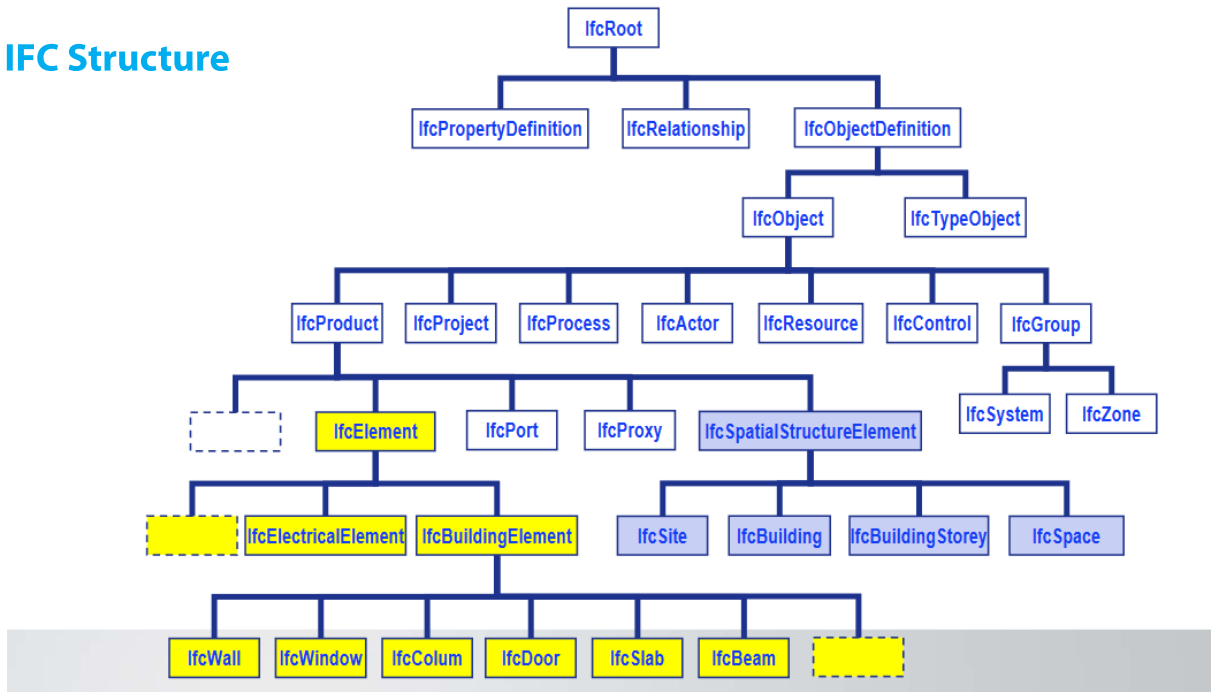


Figure 5a. IFC Structure

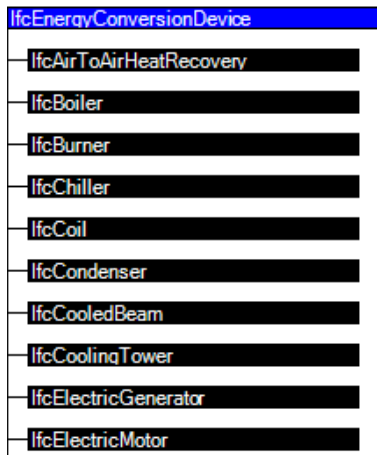


Figure 5b. Example IFC Objects.

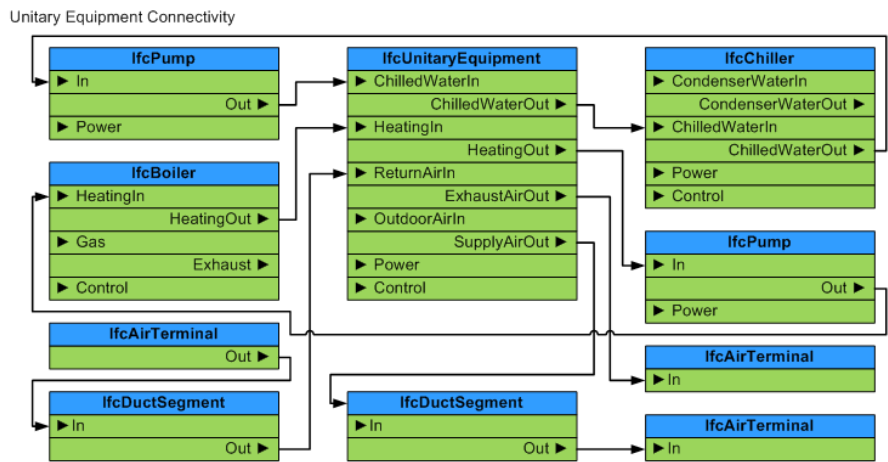


Figure 5c. Example IFC object model.

```

- <PropertySetBind referenceId="simpleOptional">
- <Rules>
- <Include subtypes="true" entityType="IfcFooting">
- <Where>
- <!-- Multiple constraints are also possible. Using multiple include rules allows optional constraints sets -->
- <!-- E.g., Any footing that is not made of concrete and has user defined field 1 set between 2 and 3, OR any footing that field 1 set to 1 and has user defined field 2 set between 0 and 42, except 10. -->
- <Compare comparisonOperator="LessThan" xsi:type="IntegerCompareType">
- <GetValue xsi:type="TemplateVariableType">
- <TemplateName>USER_FIELD_1</TemplateName>
- </GetValue>
- <ReferenceValue>4</ReferenceValue>
- </Compare>

```

Figure 5d. Example IFC XML file.

(Source: <http://www.buildingsmart-tech.org/ifc/IFC2x4/rc2/html/schema/ifchvacdomain/lexical/ifcunitaryequipment.htm>)

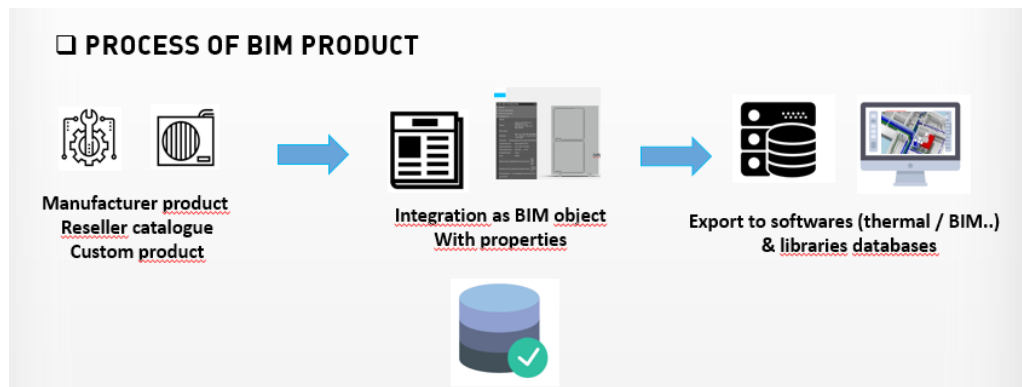


Figure 6. BIM process.

### The impact of digital product information standards

The list the standards working groups covering the information in construction works and products is below (source AFNOR).

We have selected the relevant recent works in progress impacting our products under our CEN perimeter with BIM, objects, product data, exchange information and libraries. The BIM is defined as: “use of a shared digital representation of an asset to facilitate design, construction and operation processes to form a reliable basis for decisions”.

### The relevant themes

Out of these works, here are the most important subjects we consider creating a common framework for our HVAC-R product digital harmonization:

- [Creation and governance of a data dictionary] prEN-ISO 23386: definition of properties waiting CEN public enquiry, which is the result of the initial works of AFNOR PPBIM works. For reminder, the process is as follows: Activation of Work Item / elaboration of draft (8 to 12 months)/ CEN enquiry 12 weeks / analysis of comments (max 8 months) / formal vote 8 weeks (possibility of skipping) / final work 8 weeks / publication
- [Structure of generic object in a dictionary] prEN-ISO 23387: product data templates
- Normalization of Product Data Template (PDT) structure, within a standardized dictionary (prEN-ISO 23386) and relation to IFC structure (ISO 16739).
- [Structure of product catalogue] link with ISO 16757 electronic catalogue products to see how the subject of catalogue values for instance is treated in IFC.

Indeed, the first structure to define what is a property of an object/product and what are the attributes to fill

for each property, and to what reference document it is related to and to what dictionaries. Thus a property will have an unique identifier and many attributes like in the table of Figure 8.

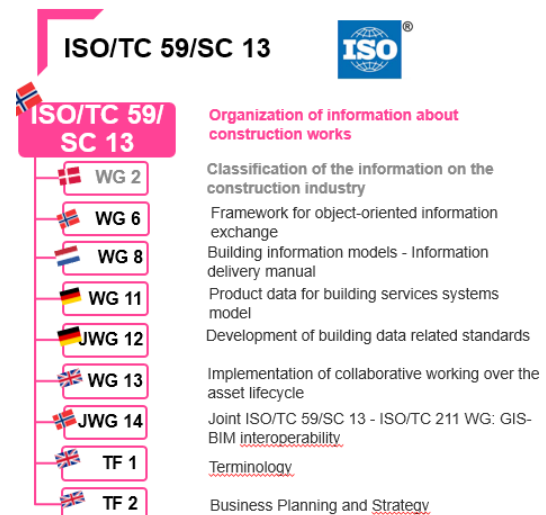


Figure 7a. ISO TC 59 standard (AFNOR source)

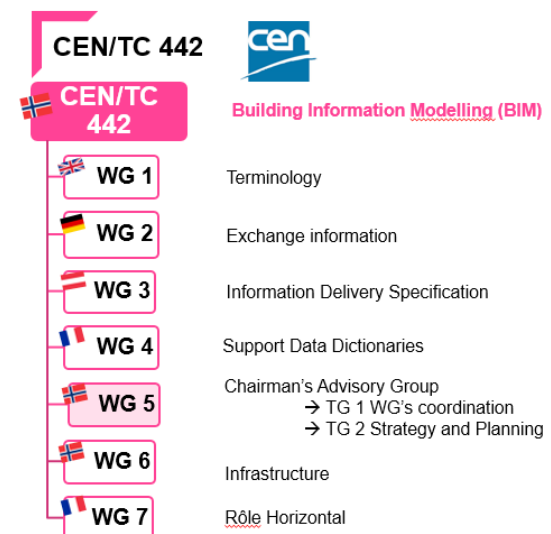


Figure 7b. CEN 442 standard (AFNOR source)



WGs (source AFNOR)	Standard & status
<b>ISO /TC 59/SC 13 Organization of information about construction works</b>	
<b>WG 6</b> Framework for object-oriented information exchange	Link with CEN TC 442 WG4 dictionaries. ISO 12006-3 Building construction -- Organization of information about construction works -- Part 3: Framework for object-oriented information. ISO 16354:2013 Guidelines for knowledge libraries and object libraries.
<b>WG 8</b> Building information models - Information delivery manual	Link with CEN TC 442 WG3. ISO /NP 21597-1 & 2 Information container for Data Drop - Exchange specification - Part 1: Container Part 2: Dynamic semantics.
<b>JWG 12</b> Development of building data related standards	WG2 ISO 16739-1 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries -- Part 1: Data schema using EXPRESS schema definitions.
<b>WG 11</b> Product data for building services systems model	WG2 prEN ISO 16757-1 & 2 Data structures for electronic Product catalogues for building services Part 1: Concepts, architecture and model & Geometry.
<b>WG 13</b> Implementation of collaborative working over the asset lifecycle	WG3 NWIP TR Guidance on how to implement EN ISO 19650-1 and -2 in Europe NP EN ISO 19650-3 Organization of information about construction works -- Information management using building information modelling -- Part 3: Operational phase of asset.
<b>JWG 14</b> Joint ISO /TC 59/SC 13 - ISO /TC 211 WG: GIS-BIM interoperability	Link infrastructure.
<b>CEN/TC 442 Building Information Modelling (BIM)</b>	
<b>WG 1</b> Strategy and Planning	
<b>WG 2</b> Exchange information	PWI Exchange format for product data template.
<b>WG 3</b> Information Delivery Specification	
<b>WG 4</b> Support Data Dictionaries	2 TGs: properties definition & product data template. prEN ISO 23386 Building information modelling and other digital processes used in construction -- Methodology to describe, author and maintain properties in interconnected dictionaries. Pr EN ISO 23387 Product data templates, for products and systems used in construction works, stored in a data dictionary framework -- Part 1: General concepts, relations, and general structure of product data templates, and how to link the product data templates to Industry Foundation Classes (IFC). PWI 442008 Product data templates, for products and systems used in construction works, stored in a data dictionary framework - Part 2: Specification of Product data templates based on harmonized technical specifications under the Construction Products Regulation (CPR), and how to link the product data templates to Industry Foundation Classes (IFC). prEN „Modelling and linking between semantic ontologies“: new TG.
<b>WG 5/TG 2</b> Strategy and Planning	Harmonization between ISO / CEN / Building-smart International.
<b>Other standards related</b>	ISO TC 184 STEP

This standard project defines also the role of experts to validate the properties. **The European dictionary can now be defined with this process using the same semantic.**

BuildingSMART International proposes its Data Dictionary BsDD to help the users finding the properties dictionaries according to each country as a work-in-progress.

Other impacting new regulation & standards projects to follow:

- Smart CE marking: a Common Working Agreement CWA 17316 Smart CE marking for Construction products is implemented with a proposal of XML format
- asset life: the ISO 19 650 on asset will impact the digital process along the project and how the data will be monitored by the different stakeholders.

PPBIM - prEN23386		
<b>group of properties (organized properties...)</b>	<b>property (inherent or acquired feature of an item)</b>	<b>attribute (any data including description, interconnected dictionaries, type, list of values..)</b>
group of properties	property	guid - unique identifier
group of properties	property	statut
group of properties	property	date of creation
group of properties	property	date of activation
group of properties	property	date of last change
group of properties	property	date of revision
group of properties	property	date of version
group of properties	property	date of deactivation
group of properties	property	version number
group of properties	property	revision number
group of properties	property	replaced by
group of properties	property	depreciation
group of properties	property	relation properties in inter
group of properties	property	creator language
group of properties	property	name language N
group of properties	property	definition language N
	property	description
	property	examples
	property	connected properties

Figure 8. Example properties.

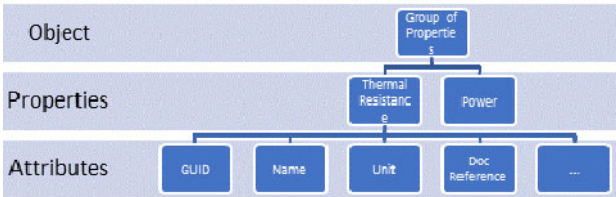


Figure 9. PPBIM Properties hierarchy.

Many points are being discussed with experts of CEN TC 442 WGs:

- How to deal with requests in IFC for catalogue products linked to other software like PIM?
- How to define product data templates?
- How to input the requirement, such as conditions of performance or regulations or project requirement, into a product using IFC. Example with “IfcConstraint” or complex properties on the way for Heat pump.
- How to define dynamic properties linked to other properties, and how to link the data together with the identifiers?
- How to qualify the source of the data in the product (declared, certified...) and the data which is modified after in a project by an author?

- How to control data using rule checking to check consistency, completeness etc... of data in IFC?

### Conclusion

This overview is showing the CEN TC 442 topics to follow, and the BIM dedicated subjects in relation to our HVAC-R products digitalization and product data management.

Now the next step is to harmonize together a European dictionary of properties for our products to be able to exchange the information.

The BIM is forcing us to structure our framework quickly and push our HVAC-R dictionary as the first step towards the BIM standard. ■

## About PRODBIM



In the context of the construction sector's ongoing digital transformation, the HVACR industry finds itself increasingly impacted by BIM (Building Information Modelling). Manufacturers are being challenged to comply with new BIM standards and working methods. The objective of PRODBIM is to support manufacturers in making effective use of the constantly evolving BIM market.

- PRODBIM is an initiative driven by Eurovent Service Company.
- PRODBIM will deliver a dedicated database online service to assist the set-up of your product data into a coherent PIM\*, fully usable for BIM market and multi-countries codes.
- PRODBIM is involved in the CEN TC 442 works and specifically in WG2 and WG4 on products, and member of BuildingSMART to follow the works.
- PRODBIM will deliver also the EPREL service for any manufacturers.
- **PRODBIM is also a Partner of REHVA.**
- PRODBIM is inviting interested HVACR manufacturers to participate in their Committees “BIM HVAC Product Database for Manufacturers” to harmonize their product properties.

**For detailed information**, please contact the author:  
Thibaud de Loynes, +33 6 30 14 45 50, [t.deloynes@prod-bim.com](mailto:t.deloynes@prod-bim.com).