Universidade do Minho
Escola de Engenharia

Andrijana Djukic

Integrated Quality Assurance and Control Framework for BIM Models during Design, Construction and Operation

BIM A+ European Master in Building Information Modelling

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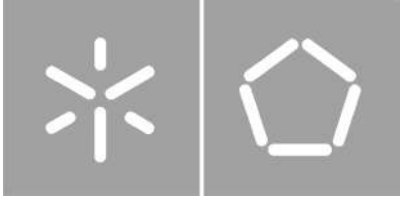

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Master Dissertation
European Master in Building Information Modelling

Work conducted under supervision of:
Helder Sousa
José Carlos Lino
Bruno Caires (Tutor in Company)

Co-funded by the Erasmus+ Programme of the European Union

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

RESUMO

A implementação do BIM na indústria da Arquitetura, Engenharia e Construção (AEC) reinventou o modelo de negócio deste sector, alterando a forma tradicional de gerir os projetos. Esta transformação teve um impacto significativo na colaboração e comunicação de dados. No entanto, a transição digital trouxe inúmeras questões sobre a Gestão da Qualidade neste novo contexto.

O modelo BIM assumiu um papel central no ambiente digital. Com todas as informações essenciais no modelo, a qualidade do modelo tornou-se crucial, o que significa que quaisquer deficiências podem causar consequências significativas, afetando o processo de colaboração global. Como resultado, a fiabilidade de todo o projeto depende diretamente da integridade do modelo em termos de qualidade. Apesar da variedade de ferramentas de verificação de modelos disponíveis no mercado, falta uma abordagem integrada à Garantia da Qualidade e ao Controlo da Qualidade que apoie a entrega do projeto desde o seu início até à entrega da obra, considerando as utilizações e os requisitos BIM definidos e reconhecendo os dados e as normas da indústria. Este trabalho revela as metodologias existentes e fornece uma análise das diretrizes e ferramentas que abordam a Garantia/Controlo da Qualidade no mercado.

A principal preocupação na obtenção da qualidade do modelo consiste em assegurar que o modelo contém todas as informações necessárias e está em conformidade com os requisitos definidos pelas partes responsáveis. No entanto, a investigação mostra que a definição inadequada dos requisitos e a conformidade do modelo com esses requisitos constituem um dos maiores obstáculos a uma colaboração efetiva entre os clientes e os fornecedores. Este estudo centra-se na exploração dos métodos atualmente utilizados para a especificação de requisitos, procurando soluções de melhoria. Para colmatar esta lacuna, esta investigação propõe uma metodologia abrangente de Garantia/Controlo da Qualidade concebida para garantir a conformidade do modelo com os requisitos específicos da entidade adjudicante. Os objetivos principais são três: em primeiro lugar, a criação de uma ferramenta que aborda a Garantia de Qualidade durante o processo de criação do modelo; em segundo lugar, os procedimentos de verificação do Controlo da Qualidade integrados na metodologia proposta; e, em terceiro lugar, a exploração das possibilidades de automatização. Além disso, este estudo estabelece as bases para investigação futura sobre o aumento da qualidade do modelo, centrando-se na automatização da especificação de requisitos.

Palavras-chave: BIM, Garantia da Qualidade, Controlo da Qualidade, Especificação de Requisitos, Verificação de Modelos.

ABSTRACT

Implementing BIM in the Architecture, Engineering and Construction (AEC) industry has reinvented this sector's business model, changing the traditional way of handling projects. This transformation had a significant impact on collaboration and data communication. However, the digital transition brought up numerous questions about Quality Management in this new setting.

The BIM model has taken a central role in the digital environment. With all essential information within the model, the quality of the model became crucial, meaning that any deficiencies can cause significant consequences, impacting the overall collaboration process. As a result, the reliability of the whole project depends directly on the integrity of the model in terms of quality. Despite the variety of model checking tools available on the market, there is a lack of an integrated approach to Quality Assurance (QA) and Quality Control (QC) that would support project delivery from its commencement to handover, considering the defined BIM uses, requirements and acknowledging industry data and standards. This work discloses existing methodologies and provides a review of the guidelines and tools addressing QA/QC on the market.

The primary concern in achieving model quality lies in assuring that the model contains all needed information and aligns with the requirements defined by the appointing parties. However, research shows that inadequate definitions of requirements and the model’s compliance to these requirements, present one of the biggest obstacles to effective collaboration of clients and appointed parties. This study focuses on exploring currently used methods of specifying requirements while seeking improvement solutions. To bridge this gap, this research proposes a comprehensive QA/QC methodology designed to guarantee model compliance with the appointing party's specific requirements. The primary objectives are threefold: first, creating a tool that addresses QA during the model creation process; second, the QC verification procedures integrated into the proposed methodology; and third, exploring the possibilities of automation. Furthermore, this study lays the groundwork for future research on enhancing the model quality by focusing on automating the requirements specification.

Keywords: BIM, Quality Assurance (QA), Quality Control (QC), Requirements Specification, Model Checking.

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1. INTRODUCTION

In recent years, the Architecture, Engineering, Construction and Operation (AECO) industry has undergone a significant digital transformation, primarily driven by the adoption of Building Information Modelling (BIM). BIM is a methodology that manages project and building design information digitally (Penttilä, 2006). Creating a virtual environment replicates the construction project and allows the creation of precise digital models of the building. Its implementation completely reshaped the traditional business model of project development and delivery, facilitating changes in not only the creation process but the way how stakeholders collaborate and manage project information as well.

The main facilitator of this transformation is the BIM model, which carries all project information, including both physical and alphanumerical characteristics (Azhar et al., 2008). All processes and extraction of essential views are based on the digital model, making it a key factor in the use of BIM (Andrich et al., 2022). Recognising that all project information derives from the model underscores the importance of assuring its quality. The high quality of the model ensures the correctness and reliability of the information contained within it, eliminating issues and misunderstandings. One of the biggest issues with quality is inaccurate, incomplete, and inconsistent information, causing decreased efficiency, design errors, and issues in the later stages of the project. Poorly defined information leads to deficient outcomes and project delays, affecting the overall process (Berard, 2012). Furthermore, low quality limits the uses of BIM model and produces inaccurate deliverables affecting all aspects of decision-making, scheduling and quantification among other uses.

This necessity highlights the significance of the implementation of Quality Assurance (QA) and Quality Control (QC) processes within the BIM Process. Technological improvement and high customer expectations in the construction industry, increased the demand for the development of QA and QC methodologies (Kerkar and Salvi, 2020). QA as a measure of prevention assuring the quality and QC as the process of verification and identifying the issues (ISO 9000:2015, 2021). The integration of these aspects ensures the accuracy, reliability of the BIM model and quality of its deliverables.

Currently, there are more than a few software solutions that integrate some level of quality verification (Cann et al., 2020). However, these tools are usually focused on addressing specific aspects of quality, therefore lacking the integrated QA/QC approach that would support project delivery considering all requested BIM Uses, Requirements and stakeholders throughout the entire project life cycle.

1.1. Objectives

Current fragmentation in the implementation of QA and QC processes leads to inefficiencies and mistakes. Moreover, it is performed involving a lot of manual or semi-automated work, wasting valuable human workforce and time resources.

As such, the primary goal of this study is to propose a methodology that could seamlessly integrate QA and QC procedures into the workflow of the company. The created methodology will be twofold: firstly, addressing QA by establishing requirements that align with both industry and company specific

standards, and secondly, tackling QC through verification of the model's compliance with the predefined Requirements.

Furthermore, the created methodology will aim to address the possibilities of automation of these processes as well. This will be achieved through answering the following objectives: understanding the process of Quality Management, identifying current status of QA/QC in the BIM, decomposition of the Model checking in order to understand its parts, proposing a methodology for enhancing model quality by integrating QA/QC processes, addressing QA through the creation of a Requirements Specificator and testing out possible QC methods through verification of a case study.

1.2. Collaborators in Dissertation

This research seeks to answer the needs for assuring quality of the models delivered to the appointing parties. It was developed in close collaboration with BIMMS – BIM Management Solutions, as a direct response to the company's necessity to elevate the quality of the deliverables. BIMMS is an international company specialized in developing and managing digital models. Working closely within company's environment was crucial to understand what the current practices are and how they can be improved. Additionally, expertise of company's professionals and their support provided needed guidance and resources to conduct this study.

1.3. Dissertation Structure

This dissertation is organized into six chapters as illustrated below (Figure 1).

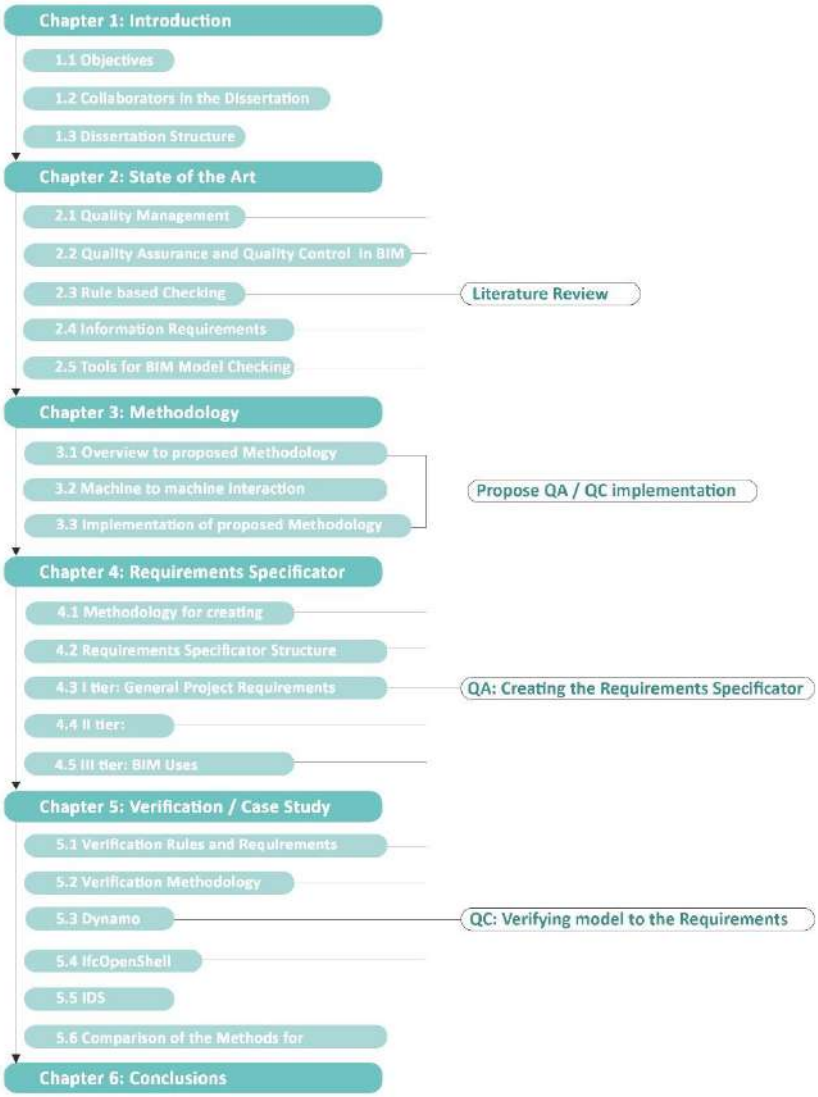


Figure 1 – Dissertation Structure

First chapter introduces the overall topic of the study, highlighting the questions it aims to address. It provides an overview of the research methodology, objectives, involved partners and an explanation of the research structure.

Second chapter dives into the state of the art. It consists of five sections aiming to address the context of model quality and current practice (Figure 2). First section provides an overview of concepts of the Quality and Quality Management, and more importantly, raises the question of managing quality in Industry 4.0. Sequentially, second section dives into the specifics of the Quality Management in BIM. It addresses two key processes which are Quality assurance and Quality Management. Through researching of the content of QA/QC guidelines, it aims to assess the current state of the quality processes in the industry. Moreover, tries to understand which aspects constitute Model checking methodology. Relying on the key factors of Model checking: rules, information and software, following sections dive into each of these specifically. Third section addresses the rule-based checking, providing an overview of the concept. Additionally, it addresses the topic of rules classifications, organization and representation, aiming for a better understanding of how the rules are specified. Forth section provides

an insight into the second aspect of Model checking which is information contained within the model. It aims to understand fundamentals of defining information requirements and reflects on the Level of Information (LOIN) concept. Fifth section of this paragraph addresses the model checking tools available on the market. It evaluates four checking tools through several components: templates and functionalities embedded in the tool, rule creation process and visualization of the results.

Figure 2 – Visualization of the information flow in State of the Art

Third chapter explains the proposed methodology and how it deals with the issue of model quality. The purpose of this chapter is to address some of the issues company encounters in the process and define new workflow that integrates QA and QC in the process of defining requirements and verifying model compliance.

The fourth chapter presents the development of Requirement Specificator. Firstly, it explains the methodology of creation and resources used. Secondly, it reflects on the logic of structuring the information. Additionally, it dives into the three sections, based on the tier structure of the Specificator. Each section further addresses each tier, explaining the creation process, requirements and content.

Fifth chapter focuses on validation and testing out the proposed framework. It evaluates three possible methods of checking the model compliance. The evaluation is conducted with the collaboration of the BIMMS company, where an ongoing project is used as subject of the checking. Each section of this chapter explains the process of conducting the checking and displays results of each verification.

Last chapter presents the conclusion of the conducted research and proposes future development.

2. STATE OF THE ART

2.1. Quality Management

In order to delve into the topic of quality assurance and quality checking of the BIM model, it is essential to break down the concept of quality and quality management first.

2.1.1. What is Quality?

There have been more than a few attempts to define the meaning of quality. Although the term is used daily among academics and practitioners, no interpretation is widely accepted. Most definitions are closely tied to the discipline they refer to, giving rather ambiguous explanations if analysed independently. Despite that, there is much consensus about the truthfulness of the statement: "Quality is what makes the difference between things being excellent or run-of-the-mill" (Sallis, 2002, p.15).

Depending on the context, definitions of quality have several approaches. Some of the definitions are as follows:

"Quality is fitness for use" (Juran, 1999, p.21).

"The first erroneous assumption is that quality means goodness, or luxury, so shininess, or weight. We must define quality as conformance to requirements if we are to manage it". (Crosby, 1979, p.1)

"Quality means freedom from deficiencies" (Badr, 2011, p.7).

The widely accepted term is the one proposed by Philipp B. Crosby. He defines quality as conformance to requirements (Crosby, 1979). This rather simple concept means that every product that reproduces planned design specifications is of high quality.

According to Garvin (1987), quality cannot be a single variable but rather multifaceted. He proposes eight dimensions (Figure 3) according to which quality can be assessed:

1. Performance – key operational feature;
2. Features – additional benefits;
3. Reliability – likelihood of product breakdown;
4. Durability – product's lifespan;
5. Conformance – meeting with specifications;
6. Serviceability – easiness of maintenance;
7. Aesthetics – attributes appealing to senses;
8. Perceived Quality – perceived by customers.

Figure 3 – Garvin's Eight Dimensions of Quality (based on Garvin, 1987)

2.1.2. Concept of Quality Management

The need for a certain quality of product or service inaugurated the need for quality management. The simplest explanation of Quality Management would be that it is a control over the characteristics that make up the quality of a product or a service. In other words, quality management is a set of different actions that are taken in order to provide quality that fits the given requirements.

According to ISO 9000:2015 (2021), quality management consists of four aspects which are Quality planning, Quality assurance, Quality control and Quality improvements (Figure 4).

Quality planning is related to the planning stage in which the quality objectives are set. Quality assurance involves assuring that requirements will be fulfilled. Quality control involves comparing the actual performance with the planned one and taking actions if they do not align. Lastly, Quality improvements deals with increasing the ability to fulfil quality requirements, through improving both planned and control processes based on the results from the control stage.

Figure 4 – ISO 9000 Quality Management Aspects (based on ISO 9000:2015, 2021)

Achieving quality through quality management and following standards can be seen as mandatory in not only providing viable product on the market but being a competitive advantage as well (Carvalho et al., 2021). In other words, managing quality should not represent just a routine activity of the company, but should be seen as a strategic imperative that contributes to overall success and competitiveness on the market.

Crosby (1979) defines The Four Absolutes of Quality Management as (1) the definition of quality is **conformance to requirements**, (2) the system of quality is **prevention**, (3) the performance standard is **zero defects**, and (4) the measurement of quality is the **price of non-conformance**.

He puts clients' requirements and needs as imperative, which goes along with his explanation that quality is compliance with requirements. Secondly, he states the importance of prevention, believing in eliminating error before happening. Through the Zero defects policy, Crosby promotes an approach of not having allowable number of mistakes at all. Lastly, managing quality is directly connected to financial aspect, where non-conformance stands for the cost of failure.

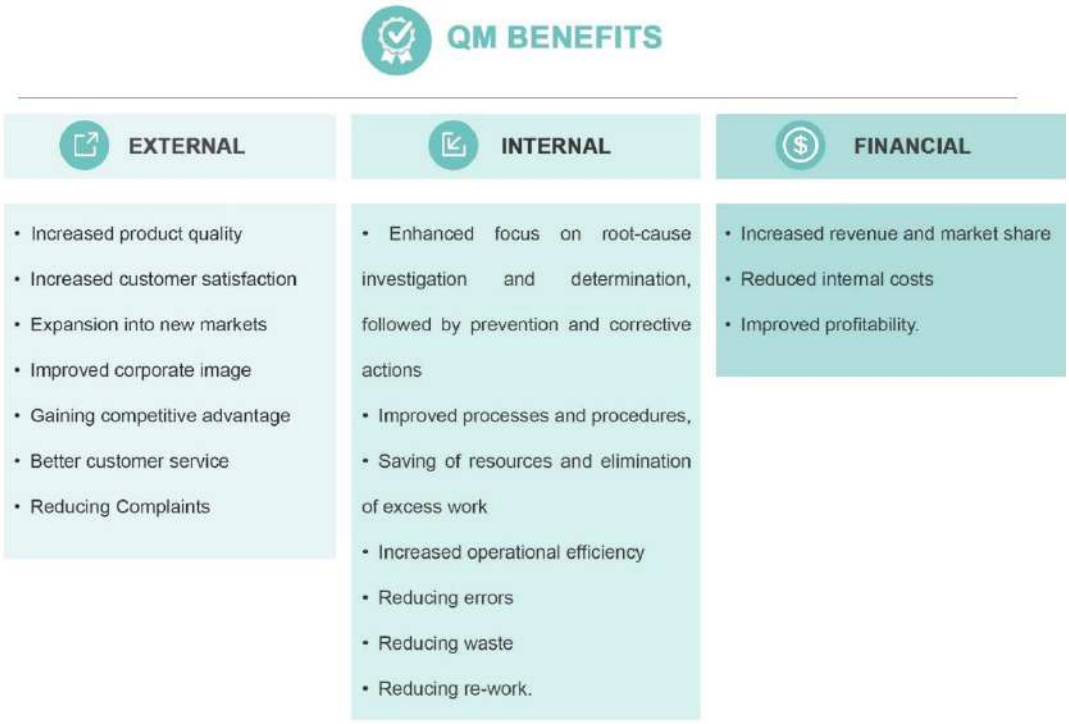
2.1.3. Costs and benefits of maintaining quality

Approaches to managing quality are diverse, depending on the discipline and main focus. Nevertheless, advantages that can be accomplished in terms of business objectives are vastly the same. Through Quality Management and setting a recognized standard, quality can be the main differentiator from competitors' offers.

Benefits of Quality Management (Sannassee and Kawthar, 2013) can be evaluated through three contexts: Internal, External and Financial.

Internal benefits are related to improvements within an organization, whereas external refer to enhancements that can be accomplished in relation to the client and on the market (Table 1).

Table 1 - Quality Management Benefits based on literature review of conducted studies (Zgirskas et al., 2021; Casadesus et al., 2001; Sannassee and Kawthar, 2013)



When it comes to the cost of applying quality, Crosby (1979) defines two types of cost. The Sum of price of conformance to requirements and the Sum of price of non-conformance.

In other words, he defines the cost of good and the cost of poor quality (Figure 5). The first one includes all planning activities needed to assure compliance to the requirements. On the opposite, if these preventive actions are not taken, there is a cost of poor quality as a result of a defective product.

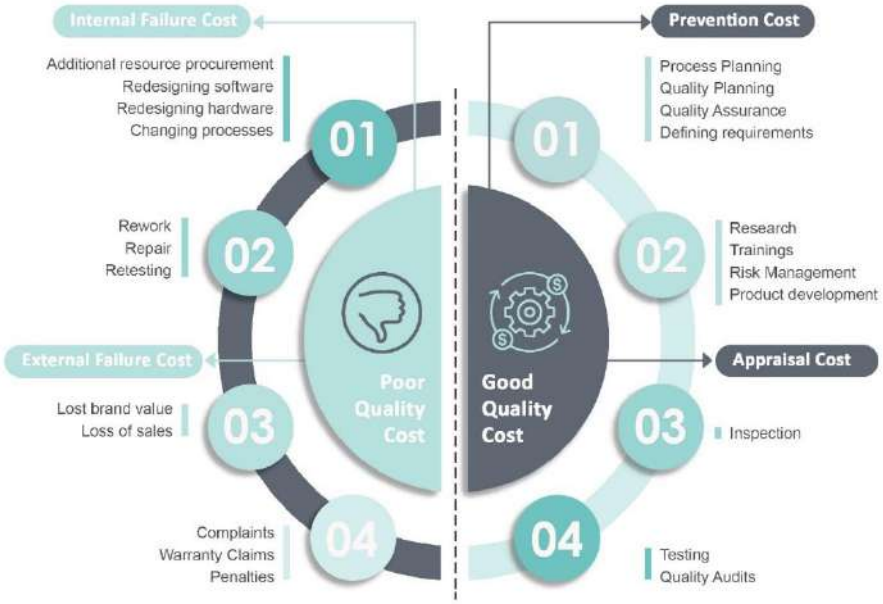


Figure 5 - Cost of good and poor quality (based on Crosby, 1979; Feigenbaum, 1956)

2.1.4. Evolution of Quality Management

There is a common misconception that the development of quality management started with the Industrial Revolution and development of mass production. The truth is that the concept of quality can be traced much further back in time, originating in the ancient period. One of the first legal documents, The Code of Hammurabi, addresses the importance of quality in several codes: "If a shipbuilder builds a boat for someone, and do not make it tight, if during that same year that boat is sent away and suffers injury, the shipbuilder shall take the boat apart and put it together tight at his own expense" (Hammurabi, 1750-1755 B.C.). It is known that Ancient Egyptians implemented a systematic quality control while building pyramids, which is shown through the structured manner and precision they were built with (Hellman and Liu, 2013).

During medieval ages, expansion of both craftsmen and manufacturing guilds contributed significantly to the development of manufacturing processes, hence quality control as well. They implemented quality controls within guild not only as a method of assuring the quality of their own product, but for comparing it to other competitors as well. (Richardson, 2004) By marking the product, the craftsman would provide proof of quality, which was acknowledged throughout the Europe.

However, a big milestone when it comes to quality management system came with the development of production methodology during the Industrial revolution. Worker's main objective became providing the product that corresponds to the sample or specification (Juran, 2010). Since both processes and products became more complex, it developed the need for checking the product quality after production. Manufacturing factories had special departments who were in charge of inspecting goods and finding faulty ones (Report et al., 2012).

Conducting quality control became a well-established part of the manufacturing process, but at the late 19th and beginning of 20th century, more attention was devoted to it from scientific and legislative side. Frederick W. Taylor (1911) developed the idea of scientific management, which was a role model for the approaches developed during 20th century. Unlike previous methods that were focused only on the final product, Taylor devoted more attention to the process and workers themselves, developing key principles for enhancing quality (Dooley, 2010).

Big attention to providing quality of production was given during II World War. The need for larger and faster production demanded the quality assurance system. Along with complexity, the need for high quality and safety was imperative so this period birthed quality guides and standards (Juran, 2010). The post-war period is considered to be the beginning of the Total Quality Approach. W. Edvards Deming and Joseph M. Juran were the founding fathers of new methodology developed for the Japanese market. It can be concluded that they heavily relied on Taylor's theory of managing quality, not only of the product but of the process and services as well. Evidently, this approach showed as very successful, bringing Japanese products to the top of the list when it comes to the quality, in just a short period of time.

Last milestone when it comes to quality management is an ongoing process still, dealing with quality in digitized manufacturing sector. Technological advancement at the beginning of 21st century fundamentally changed the business model, starting the period of 4th Industrial Revolution, otherwise

called Industry 4.0. Digital transformation brought into focus the use of digital copies of real world (Turk and Klinc, 2019) which generated Quality 4.0, a branch of quality management using digital technologies.

Given timeline (Figure 6) provides an insight into the progress that quality concept experienced during different time periods, confirming its volatility and need to adapt in order to conform. This raises a question of what the future trends are and how they will influence the evolution of managing quality.

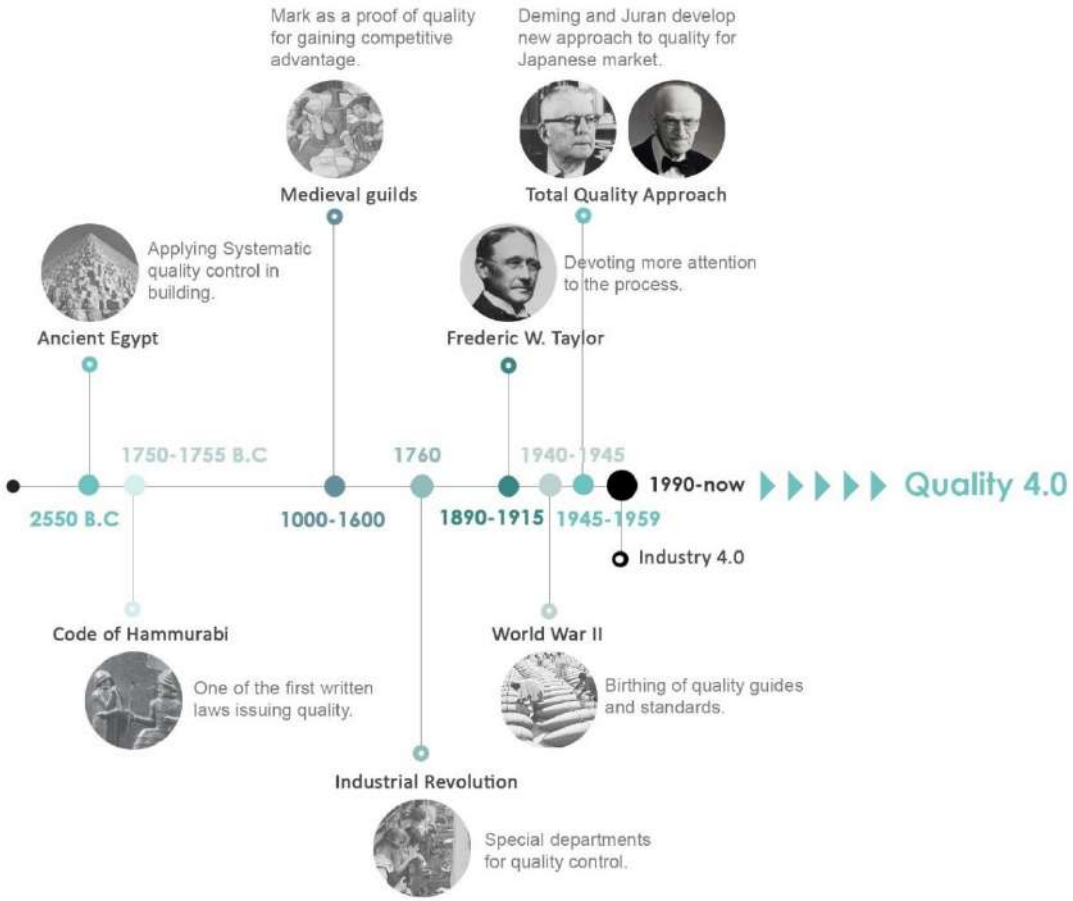


Figure 6 - Quality Management Timeline

2.1.5. Automation of quality

As indicated previously, Quality 4.0 is a concept concerned with managing the quality in the Industry 4.0. It can be defined as a "combination of new technologies, standard quality tools and methods in order to achieve superior performance, higher operational excellence and optimal innovation" (Antony et al., 2022, p. 8).

The main advantage of this approach to quality management is that it is focused on the use of digital tools that allow intensive monitoring of all activities. Focus is being put on the use of machine learning, minimizing human intervention and replacing it with computer-based solutions.

As underscored by Milunovic et al. (2019), foundation of Quality 4.0 is based on the use of advanced technologies such as Artificial Intelligence, Big Data, Blockchain, Deep Learning, Enabling technologies, Machine Learning and Data Science (Figure 7).

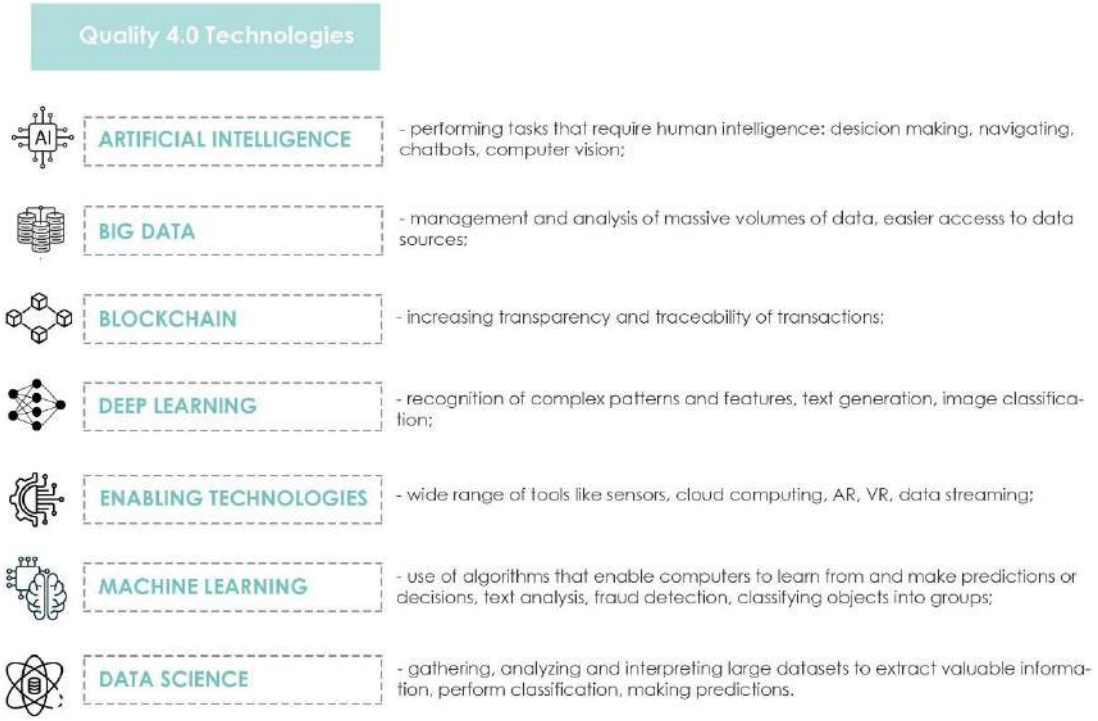


Figure 7 - Description of Quality 4.0 Technologies and Tools (based on Radziwill, 2018)

Embracing the capabilities offered by these technologies would elevate the process of quality control beyond traditional methods and boundaries, reshaping the standard industry procedures.

Moreover, there are more than a few benefits that can be detected with automatization of quality management. Radziwill (2018) groups them into seven categories: Augmentation of human intelligence; Improving quality and speed of making decisions; Increasing transparency, traceability and auditability; Predicting changes and adapting to new circumstances; Be adaptable to new situations and knowledge, anticipate changes, and expose irregularities; Constant improvement and developing of new business models through advancement of relationships and the concept of trust; Knowledge by developing one's capacity for self- and other awareness.

In conclusion, the range of benefits that automating quality brings is perceived as a necessary step in aligning with the digital transformation of the industry.

2.2. Quality Assurance and Quality Control in BIM

2.2.1. General Overview

The question of managing quality in the construction industry is significantly more complex compared to other industries. It includes not only the quality of the building, which is the final product, but all the

processes occurring during the project phases. Use of BIM already downsized the percentage of usual drawbacks significantly but raised the issue of managing construction quality in digital environment.

Data quality management consists of two concurrent processes (Doukari and Motamedi, 2022): **Quality Assurance (QA)** and **Quality Control (QC)**.

Both QA and QC represent tools for digital Quality Management, and very often, they are mistaken. So, first of all, it is necessary to acknowledge the meaning of each concept.

As defined by ISO 9000:2015 (2021) **Quality Assurance** is part of quality management that is focused on providing confidence that the quality requirements will be fulfilled. Its application has two main objectives (COBIM, 2012): Internal, focused on improving design and External, improving the exchange of information between different parties. It is a set of systematic and planned activities that ensure integration of the quality at the beginning of the project.

ISO 9000:2015 (2021) defines **Quality Control** as part of Quality Management focused on fulfilling those requirements. QC is based on comparing different data with established standards and analysing the differences between them. Controls are based on different types of checks which are grouped into subsets depending on their purpose.

In other words, QA is the process aligned with creating deliverables, whereas QC is the verification of those deliverables (ViBIM, 2020) (Figure 8).

Figure 8 - Difference between QA and QC (based on Rogers, 2023; Stanton, 2022)

2.2.2. The status of QA/QC Guidelines for BIM

Since quality checking represents one of the essentials of BIM, there are more than a few guides and manuals dealing with this topic. Some guidelines refer to it explicitly, whereas others address certain aspects, such as modelling requirements, that are an integral part of quality assurance process. The objective of the study in this paragraph is to evaluate the level of information on this subject available

in the market. This research involves compiling and assessing a collection of documents provided by various sources. The selection criteria were as follows:

Date of publishing: To assure that reviewed content remains current, documents published from 2012 were selected for research;

Guidelines content: Given that the research primary focus is on the model and quality checking, documents that cover these topics were selected.

In the following table (Table 2), a list of the evaluated guidelines is provided, followed by a short description of the quality content of each one.

Table 2 – Evaluated guides information

Document Name	Publishing Organization	Publishing Country	Publishing Year
GSA BIM Guide	U.S. General Services Administration	USA	2016
BIM Essential Guide	Building and Construction Authority	Singapore	2013
NATSPEC National BIM Guide	Construction Information Systems	Australia	2022
Singapore BIM Guide Version 2.0	Building and Construction Authority	Singapore	2013
COBIM Series 6	COBIM	Finland	2012
Statsbygg BIM Manual 1.2.1	Statsbygg	Norway	2013
GSFIC BIM Guide Series 01	Georgia State Financing and Investment Comission	USA	2013
The New Zealand BIM Handbook	BIM Acceleration Committee	New Zealand	2019
CIC BIM Standards General	Construction Industry Council	Hong Kong	2021
AEC (UK) BIM Technology Protocol	AEC (UK)	UK	2015

GSA BIM Guide 07 (2016) tackles the topic of quality in two ways: addressing the general requirements for modelling and quality control procedures. It provides practical guidance for modellers, which implicitly leverages overall quality of the model, preventing the common irregularities that appear due to bad modelling practices.

BIM Essential Guide - For BIM Execution Plan (2013) is a set of documents designed for different stakeholders: architectural consultants, MEP consultants, Civil and Structural consultants and others. It addresses the quality level needed for each phase and provides modelling guidelines for each discipline, differing the requirements depending on the project milestone.

NATSPEC National BIM Guide (2022) brings QA and QC in relation to information management and modelling standards: “model to standard, check to a standard”. It provides general modelling guidelines on data structure and sharing of the model but lacks detailed information.

Singapore BIM Guide Version 2.0 (2013) indicates the responsibility of the BIM Manager in defining the Quality Assurance Plan which should specify data requirements and performed checks. The guide provides a list of aspects that should be taken into consideration: Modelling Guidelines, Dataset Validation, Interference Check and Validation of data used in cross-disciplinary coordination.

COBIM Series 6: Quality Assurance (2012) divides QA into two main categories: checking and analysis. The first one as a method of verifying the BIM file and information it contains, and second as producing information refined from the BIM.

Statsbygg BIM Manual 1.2.1 (2013) does not explicitly delve into the topic of QA and QC but provides modelling guidelines that can be referenced when defining requirements. It sorts them according to discipline and stage, following the IFC schema from project information to more specific.

GSFIC BIM Guide Series 01: Model Analysis and Validation (2013) is a guide mainly intended for Architects and Engineers. It provides guidelines regarding both geometrical and non-geometrical data but is reserved only for Design requirements.

The New Zealand BIM Handbook – Appendix A – Modelling and Documentation Practice (2014) is a short document listing general modelling guidelines and quality control measures.

CIC BIM Standards General (2021) goes through the concept of QA and BIM Audit, grouping the checks into several categories. Modelling requirements are provided in detail, containing even the guidelines referring to annotations and line weights.

AEC (UK) BIM Technology Protocol (2015) points out the importance of quality throughout the document but lacks any further details on the topic. It provides detailed guidelines for project information, naming convention and classification following BS.

Each reviewed document covers a variety of subjects related to BIM. The objective of this research is to assess the current status of QA/QC content within the industry guidelines, so the evaluation presented below focuses on these aspects. The idea is to illustrate to which extent and detail these topics are covered in the selected manuals. In the assessment process, all aspects associated with achieving model quality are taken into consideration. They are classified into three sections: QA / QC, Modelling requirements and Standards and Conventions. Depth by which each topic is processed is classified by three levels: low=1, medium=2 and high=3.

Table 3 – Results of the evaluation of selected guides

Low=1 Medium=2 High=3

Document Name	QA / QC	Modelling Requirements	Standards and Conventions
GSA BIM Guide	3	2	3
BIM Essential Guide	2	3	2
NATSPEC National BIM Guide	1	2	1
Singapore BIM Guide Version 2.0	3	3	1
COBIM Series 6	3	2	1
Statsbygg BIM Manual 1.2.1	2	3	3
GSFIC BIM Guide Series 01	1	3	3
The New Zealand BIM Handbook	1	2	1
CIC BIM Standards General	2	3	1
AEC (UK) BIM Technology Protocol	1	3	3
	21	25	19

Results of the analysis of provided BIM guides (Table 3) show the overall attitude towards QA and QC which is that majority of them point out the importance of quality but lack detailed methodology and requirements. This only confirms the need for creating a guideline that would specify thorough requirements for assuring the quality of the model.

2.2.3. BIM Model checking and QA/QC

BIM Model checking represents a pivotal part of Quality Assurance and Quality Control processes, being the necessary step in ensuring compliance with the requirements (Eastman, 2012). As stated in COBIM - Series 6 (2012), only 5-10 % of project information is systematically checked in a standard process.

Model checking consists of three components (Seib, 2019): **Rule sets**, **Information** contained within the model and **Software** (Figure 9).

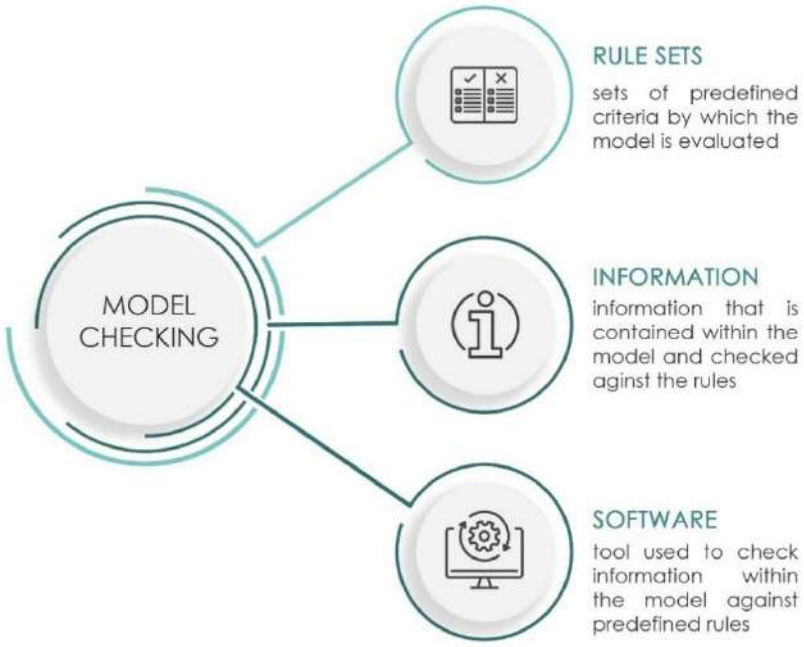


Figure 9 – Model checking components

Level of performed checks is directly influenced by all three variables that are dependent on each other. Software's functionalities need to support performing developed rules. Tool must be capable of executing the established rules properly, but also access and process the information within the model. At the same time, rules must be designed, taking into consideration how information is stored and what are the checking possibilities of the software. Thus, all three components need to be aligned for accurate and reliable model checking.

Hjelseth (2016) classifies model checking's into following types: Validation checking, Model content checking, Smart object checking and Design option checking.

Validation checking is a set of checks based on verifying compliance of design to the predefined rules. The content of rules is diverse and can be based on different standards and regulations. Depending on the type of data that is being checked, it is grouped into two subsets: geometry-based checking like Clash Detection and information-based checking like Code Compliance (Hjelseth, 2015).

Model Content checking is intended for verifying the content of the model, i.e., the relevance of provided information for the intended use (Hjelseth, 2015). It is based on the Exchange Information Requirements

(EIR) through which are defined geometric and alphanumerical information required in the model (ISO 19650-1:2018, 2018). Content checking enables having required data and avoiding information waste.

Adaptive model checking is based on the use of smart objects that are able to automatically adapt to changes in design based on predefined rules embedded in them (Hjelseth, 2015). Although the application of this type of checks is not widely applicable, it is fairly common with the use of parametric objects. The level of their adaptability depends on the amount and type of rules controlling the behaviour.

Guidance or otherwise known as Design option checking is a type of check that serves as a guideline providing designer with several solutions. It is more complex comparing to other types of checking because it is based on predefined rules and a list of possible solutions (Hjelseth, 2015).

In their research Mirarchi and Pavan (2019) address data quality within the models, focusing on three key dimensions which are **Accuracy** – data being correct and reliable, **Consistency** – correct use of semantic structure and **Completeness** – information structure satisfying requirements.

Accuracy of the information is vital since inaccurate data can compromise the project outcome. Consistency simplifies data interpretation and avoids making incorrect assumptions. Completeness guarantees that the model fulfils its intended purpose. They present the foundation of model integrity, meaning that quality assurance and model checking procedures should be focused on addressing these three dimensions.

2.2.4. Challenges of applying BIM Model checking

Despite the continuous emphasizing of the importance of performing BIM model checking, there are still many difficulties being faced in this matter. Although the majority of research focuses on technical challenges, the number of existing model checking tools implies that this is not an only challenge. Depending on the nature of the obstacles, several types of issues can be observed e.g., technological, societal, commercial, etc.

One of the main issues with model checking is creating the rulesets, in other words, interpreting human-readable rules to machine learning. Hjeslseth (2015) conducted a study focused on processing of rules based on BIM-guidance from Statsbygg. Results showed that only a third can be automatically interpreted, whereas the rest must involve manual processing. In relation to this, as mentioned previously, one of the biggest drawbacks is lacking specific guidelines that would intelligibly state rules that need to be implemented, hence simplifying the process of interpreting.

The problem with large number of tools, though the situation is changing in past few years, is that they use “black-box” approach, restricting users of model checking according to their customized rules. Hard-coded approach does not adapt to changes and not only limits users, but affects relevancy of the checking as well e.g., assessing design according to latest standards (Gade and Svidt, 2021).

Societal challenges are usually seen as irrelevant but present a large drawback in efficient model checking. Murphie and Potts (2017, cited in Gade and Svidt, 2021, p.3) state that the relationship between technology and society is not just cause-and-effect formula, but rather an interplay, where

technology operates and is being operated in a complex social field. The biggest issue regarding the user's aspect is that the more comprehensive the process is, user is less likely to understand it. Consequently, being reluctant to trust the process and results, the user will more likely return to previous methods in which he can rely.

2.3. Rule Based checking

Rule based checking refers to the process of BIM model checking, where information within the BIM model is checked based on the conditions specified by predefined rule sets.

2.3.1. Background on rule checking

Rule-based checking systems are systems that assess design through applying rules or constraints, giving pass, fail, warning or unknown as a result (Eastman et al., 2009). Eastman et. al. (2009) state that rule checking process consists of four stages: Rule interpretation, Building model preparation, Rule execution and Rule check reporting stage.

Rule interpretation stage is part of translating the human-interpretable rules to computer-processable form. This step is vital for the automation of the process (Sydora and Stroulia, 2020). A common method is creating a table consisting of parameterized rules (Zhang et al., 2012). Model preparation stage consists of insuring that the building model is adequate for performing the check. In other words, that it provides needed information in appropriate structure e.g., object name, attributes, relationships et al. (Zhang et al., 2012). This usually includes following guides that specify modelling requirements for certain check e.g., Singapore BIM Guide (2013). Other method is using model view definitions (MVD) to assure the existence of needed parameters (BuildingSMART, 2019). Execution stage consists of two parts (BuidlingSMART, 2019): mapping in-between model and created rules; and actual performing of the check. Final step of the process is reporting the results which can be graphical or textual.

Zhang et al. (2022) state that there are three main topics related to rule-based checking: Rule Classification, Rule Organisation and Rule Representation.

2.3.2. Rule Classification

Majority of papers dealing with the topic of rule-based checking proposes some classification method for grouping the rules. Solihin and Eastman (2015) classify rules according to the complexity of their processing into four categories:

Class 1—Rules that require a single or small number of explicit data;

Class 2—Rules that require simple derived attribute values;

Class 3—Rules that require extended data structure;

Class 4—Rules that require a "proof of solution".

2.3.2.1. Class 1 – Rules that require a single or small number of explicit data

This class checks "explicit attributes and entity references" (Eastman, 2015) focusing on a single or small amount of data. This group of rules is the simplest one to process considering the availability of information that needs to be assessed. Hence, it is retrieved directly from the entity, extracting relevant attributes and properties, or through parsing its relationships.

Rule example: Railing height shall be 900 mm or more.

Explanation: This rule falls under Class 1 as it involves a straightforward verification of an explicit property. The rule checks the height property of a railing entity. If the height is equal to or greater than 900 mm, the rule is satisfied.

2.3.2.2. Class 2 - Rules that require simple derived attribute values

This class of rules is a bit more complex than the previous one, since it cannot be assessed directly, but the values are derived using different relationships. This class does not generate new data structures but uses a combination of multiple values in order to check the required one. Unlike the Class 1 where values are explicit, this type of rules often require calculations including different measurements and distances.

Rule example: If the ramp landing has direct entrance, landing width needs to be 1200 mm plus the clearance space of the door.

Explanation: This rule belongs to Class 2 as it requires derived values. It checks the landing width, which is calculated by adding 1200 mm to the clearance space of the door. The calculation involves use of multiple attribute values to assess compliance.

2.3.2.3. Class 3 - Rules that require extended data structure

This group is significantly more complex than the previous two since it requires extended data structure, retrieving data that is stored externally e.g., topological, geometrical and other properties. It requires creating spatial structures that will hold the information about paths, distances etc. This methodology is usually used for complex requirements such as fire safety exits and code checking.

Rule example: Maximum distance between Fire Alarm Call Points

Explanation: This rule falls under Class 3 as it requires extended data structure. It creates a spatial structure to identify distance between points and then checks calculated distance against specific standard.

2.3.2.4. Class 4 - Rules that require a "proof of solution"

This classification differs from the rest since it is not a standard verification rule but a proof of solution. Meaning it focuses on the ways how the criteria can be satisfied, rather than if it is satisfied. Usually, it involves modifying the model with temporary data needed to find solutions. Solutions are provided from the knowledge base.

Rule example by Estman and Solihin (2016): “Design columns with holes at 21 and 42” (0.53 – 1.06 m) above the floor level to provide support locations for lifelines and guardrails”

Explanation: This rule belongs to Class 4 as it requires proof of solution, meaning that the software uses knowledge-based system to create design that complies to the requirements stated in the rule.

2.3.3. Rule Organisation

Rule organisation represents a process of structuring rules in systematic and logical manner enabling effective execution and management. Although it is a crucial aspect when dealing with rule-based systems, as Zhang et al. (2016) explain, only a small number of studies take into consideration the rule dependencies and relationships. One of the most common methodologies is organizing rules into thematic groups, based on the subject. This type of organization ensures that the related rules are grouped together, making it easier for users to navigate and understand them. Another effective way of organizing is using hierarchical structure. It involves structuring in a tree-like manner, where rules are placed on different levels. This approach addresses hierarchy relationships between the rules, where higher level tiers address general principles, whereas lower levels provide more specific details. For the systems where the order of execution is important, dependency organization can be involved. This approach organizes rules based on their interdependencies, so they are performed sequentially, one rule relying on the completion of the other. In their research Zhang et al. (2016) reflect on some of the proposed strategies for organization, such as object-oriented organization and SASE (Standards Analysis, Synthesis and Evaluation) methodology. Object-oriented approach is based on organizing rules around objects, so the rules that deal with the same objects, are structured together. This method connects the rules to specific entities they apply to, making it easier to manage them. While object-oriented organization focuses on the interaction of rules and objects, SASE methodology addresses overall structure and relationships. For bigger number of rules, this approach can be difficult to manage. It includes two main networks, Organizational and Information. Organizational one focuses on the overall structure and order, whereas information network provides connections between the rules.

2.3.4. Rule Representation

Rule representation is pointed to the use of computer-readable method to represent building rules without changing the meaning of the native text (Soliman-Junior et al., 2021). In other words, rule representation refers to the way rule is expressed within a system. There are different methodologies addressing this. Solihin and Eastman (2016) list four main categories: production rule, semantic rule structure, logic-based implementation and language driven approach.

Production rule is considered to be one of the earliest methods, using the “if<conditions>then<actions>” structure. Zhang et al. (2016) point out that the main advantage of this approach is the simplicity of application. However, limitations are that it deals only with explicit data and is not able to illustrate relationships between the rules. This methodology is focused on the direct condition-action relationship, whereas semantic rule structure considers the underlying context, offering broader understanding of the rule. The main methodology built on this approach is RASE, developed by Hjelseth and Nisbet (2011). This method is based on four operators: Requirement, Applicability, Selection and Exception. It keeps the original text but adds interpretive mark-ups during the process to enable automatic system

understand rules more effectively (Zhang et al., 2016). Since its main purpose is defining semantic rule structure, it needs additional method for rule execution. Another method based on semantic approach is Semantic web. Standard language of semantic web is Resource Description Framework (RDF) graph structure, meaning it uses the triple form also known as RDF triplets. This structure follows a subject-predicate-object format. Pauwels et al. (2010) explain that RDF graphs can be further enhanced by applying specialized vocabularies and ontologies using RDF Schema vocabulary (RDFS). RDFS enables augmentation of basic RDF statements, expressing relationships between entities and specifying constraints. As the complexity of structure grows, a more advanced mechanisms are employed. For more complex ontologies RDF graphs are built with Web Ontology Language (OWL), otherwise known as OWL ontologies. An OWL ontology can include descriptions of classes, properties and instances, allowing specification of more complex rules. Logic-based methodologies are used by commercial software's such as Solibri and represent black-box approach that is difficult to maintain. Language driven approaches include domain-specific languages and visual programming languages. One of this type is BERA language (Building Environment Rule and Analysis Language) which is domain specific language intended for querying information from the model (Eastman et al., 2015). Unlike generic programming languages, this language is user-friendly and intuitive for industry professionals. Its main limitation is that it cannot support more complex rules beyond its predefined syntax.

2.4. Information Requirements

In the process of BIM model checking, managing the level and quality of information is crucial, as data quality directly affects the accuracy of any analysis conducted using that data (Mirarchi and Pavan, 2019). Using suitable information not only prevents under and over production of data but allows automation of checking as well.

2.4.1. Defining Information Requirements

Information requirements are defined as "the request for explicit information to be delivered at a given time of the project to an indicated recipient, in a prescribed method and for a given purpose" (Tomczak et al., 2022, p. 2). Based on its use, Information Requirements can be organised into: Organizational Information Requirements (OIR), Project Information Requirements (PIR), Exchange Information Requirements (EIR) and Asset Information Requirements (AIR), which can further be detailed in the BIM Execution Plan (BEP) among other documents.

In order to utilize delivered information, it is critical to understand the purpose for which it is intended. BS EN ISO 19650 (2020) states that beforehand of considering information itself, should be understood why information is needed, describing it across four main factors: **Purpose**, which is the need that should be fulfilled, **Content**, which can be an overall content of the information or geometrical or alphanumerical information of an object, **Form**, which is the way how it is being presented e.g., drawing; and **Format**, which is the way it is being encoded e.g., IFC.

Providing appropriate Information Requirements, hence enabling successful information exchange and use, is directly dependant on defining the correct level of information that is being used.

2.4.2. Level of Detail vs. Level of Development vs. Level of Information Need

There are many different approaches to define information requirements and many confusions about the same. In context of defining necessary level of information, for a long time, two terms have been used interchangeably, Level of detail (LoD) and Level of development (LOD). It can be concluded that LOD was built upon the LoD definitions, following the five-level hierarchy (Abualdenien and Borrman, 2022). Although there is a great misconception that the meaning is the same, Level of detail stands for how much detail is included in the model element, as an input to the element itself, whereas Level of development stands for the degree to which both geometrical and alphanumerical information has been thought through, being a reliable output (New Zealand BIM Handbook, 2014). On international level these approaches caused misunderstandings and improper use causing information overload and overall inefficiency. If there were ten experts in the field explaining the LOD of the same element, there would have been ten different explanations (Bolpagni, 2020). By introducing Level of Information Need it was intended to overcome LOD limitations and focus on the data required to perform a specific task like Energy Analysis or Quantity Take Off (QTO). According to ISO 19650 (2018) Level of Information Need is determined by the minimum amount of information that is needed to comply to relevant requirement and anything beyond this minimum is considered a waste. Unlike LoD and LOD that derive on explicit levels, Level of Information Need considers this approach to be too constraining for capturing information requirements.

2.4.3. Level of Information Need

BS EN ISO 19650-4 (2020) defines Level of Information Need as a framework for defining quality, quantity and granularity of information requirements. As it was already mentioned, Level of Information Need was developed with a goal of overcoming inefficient use of LOD levels, as a lean approach focused on client's needs. The most important aspect of Level of Information Need is that it is purpose driven, based firstly on defining the use of information.

EN 17412-1 (2020) lists four main prerequisites () needed to define information context: **Why** is the information needed? – Purpose, **When** is the information needed? – Information delivery milestone, **Who** requires and delivers information? – Actors and, **What**? Object within breakdown structure – The requirement is connected to (Figure 10).

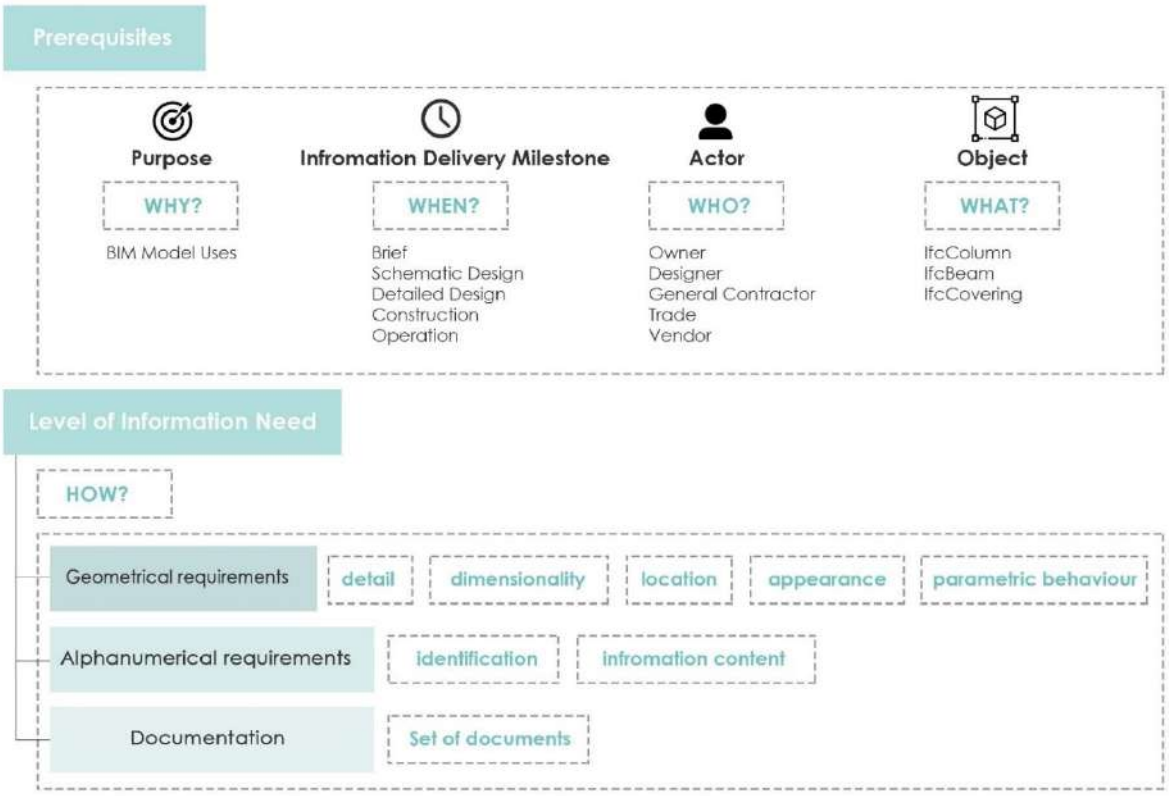


Figure 10 - Level of Information Need structure (based on Bolpagni, BIM CPH, 2022)

In order to closely define information, firstly it is needed to understand its purpose, interpreting it through specific BIM Model use. Secondly, defining in which project phase information is being delivered, connecting the information to 'when' instance can in large portion determine the type and quantity of required data like Energy Analysis in planning phase based on mass vs. creating complex Energy model in construction phase. Thirdly, distinguishing for whom the information is provided like a contractor or facility manager; and lastly, consider the objects within a breakdown structure.

Level of Information Need specifies three sub-divisions of information requirements (BS EN ISO 19650-4, 2020):

- **Geometrical information**, Geometrical information is specified through following aspects: Detail, Dimensionality, Location, Appearance and Parametric behaviour.

- **Alphanumerical information**, Alphanumerical information is specified through: Identification and Information content.

- **Documentation**. Types of documents include: Reports, Specifications, Manuals, Photographs, Hand-drawn sketches, Signed documents and Hard copies.

As stated by Bolpagni (2022), the purpose of using Level of Information Need is to: avoid waste, provide the right information to the right actor at the right time and enable automatic compliance checking.

2.4.4. Methods for specifying Information Requirements

Despite the obvious demands for defining methodologies that would be used for specifying Information Requirements, there is a lack of scientific research on this subject. Majority of effort has been put from the side of BuildingSMART (BuildingSMART, 2022) to provide needed consistency and automation in this field. Methodologies evaluated below are part of the list of methods for specifying information requirements created by Tomczak et al. (2022).

The most frequently used method for specifying Information Requirements is still text-based and usually includes text files that explain requirements (Tomczak, 2022). These files can be generated in multiple ways, using text editors or tools provided by different vendors. Though this method can be seen as outdated it is still widely used due to its simplicity. More advanced method of specifying information associated with building products is using Product Data Templates (Martins and Costa, 2018). Standardized structure allows easy exchange between providers and users, as well as processing by different software applications. This enables data to be easily extracted, displayed and integrated into the model or software tools. Another method, as explained in the previous chapter, is Level of Information Need, which is a standard that specifies Information Requirements through defining geometrical requirements, alphanumerical requirements and documentation needed for specific use. One of the ways to define computer interpretable exchange requirements is by using Model View Definition (MVD). MVD presents a specific implementation level of Industry Foundation Classes (IFC), defining a subset of information that should be included in the model, as well as the way it is structured. It allows user to filter out the information needed for specific use. Although it is possible to create custom MVD which is tailored to specific requirements, there are several concerns addressing this. Firstly, it requires good understanding of the IFC schema, and it should be ensured that provided IFC files can be interpreted by other software applications, complying with industry standards. To overcome these limitations, Information Delivery Specification (IDS) format has emerged. IDS is an XML-based exchange format that defines information requirements. This format enables defining different type of information that needs to be contained within the model or specific entity, allowing user to specify accurate values or their restrictions. Limitation of IDS is that it addresses alphanumerical information and is not intended to specify certain rules or design requirements. Although they cannot be addressed explicitly, value constraints can be used to deal with this type of requirements. Important aspect of IDS is that it can be used as complementary specification to the Level of Information Need, allowing alphanumerical requirements to be expressed in computer-interpretable way, enabling automated compliance checking (Figure 11).

Example 1.Textual file explaining the requirement.
Source: Statsbygg's SIMBA (https://sites.google.com/view/simba-bim-krav)

Wall

The wall represents a vertical construction that bounds or subdivides spaces. Wall are usually vertical, or nearly vertical, planar elements, often designed to bear structural loads. A wall is however not required to be load bearing.

NS3451:

IFC 4 Add2: IfcWall

Level of Information (LOI)	B3.1	B3.2	B4.1	B5.1
LoadBearing IFC 4 Add2 : Pset_WallCommon.LoadBearing	x	x	x	x

Example 2. Product Data Template version of the example above

Template Category	Wall				
Information Category	**Parameter Name**	**Value**	**Units**	**Reference**	**Notes**
Structural	LoadBearing			00123	Should be True or False.

Example 3. Part of the MVD with the LoadBearing requirment defined with TemplateRule

```
<ConceptRoot name="Wall" applicableRootEntity="IfcWall">
    <... />
    <Concept uuid="..." name="LoadBearing">
      <... />
      <Template ref="..."/>
      <Requirements>
        <Requirement requirement="mandatory" .../>
      </Requirements>
      <TemplateRules operator="and">
          <TemplateRule Parameters="Set[Value]='Pset_WallCommon' AND
          PropertyName[Value]='LoadBearing' AND Value[Exists]=TRUE"/>
      </TemplateRules>
    </Concept>
</ConceptRoot>
```

Example 4. IDS requirement for LoadBearing parameter defined with restriction in XML

```
<applicability>
    <...>
        IfcWall
    </...>
</applicability>
<requirements>
    <property minOccurs="1" measure="String">
        <propertySet>
            <simpleValue>Pset_WallCommon</simpleValue>
        </propertySet>
        <name>
            <simpleValue>LoadBearing</simpleValue>
        </name>
        <value>
            <xs:restriction base="xs:boolean">
                <xs:enumeration value="true">
                <xs:enumeration value="false">
            </xs:restriction>
        </value>
    </property>
</requirements>
```

Example 5. Same IDS requirement but displayed in a user interface (own graphic).

Figure 11 - 5 Examples of specifying information requirements (Tomczak et al., 2022)

In their research of methodologies for specifying Information Requirements Tomczak et al. (2022) conclude that IDS is the most advantageous method when it comes to automated validation of the alphanumerical information content within the model.

2.5. Tools for BIM Model Checking

In BIM model checking process, tools serve as essential instruments for execution of the rules, assuring that the BIM model complies to predefined requirements and standards. The objective of this chapter is to assess some of the model checking software's that are currently available on the market. The aim is to lay out comprehensive overview of the software functionalities and provide an insight on how they address the critical aspects of QA / QC. Hence, the research addresses three topics: functionalities and templates embedded within the tools; rule creation process and visual representation of the verifications.

Throughout the research of the selected tools, their possibilities, as well as constraints shall be acknowledged. This assessment was made only for academic purposes and can´t be used for commercial purposes and its conclusions and methodology are restrained to the knowledge experience and availability of the researchers involved, so it can´t be considered exhaustive for all the possible evaluations. This assessment was done under the sole intention of framing this state of the art and under the ethical principles of this academic work without any bias for any of the products.

2.5.1. Brief overview of selected tools

Tools selected for evaluation are: Revit Model Checker, Solibri, Navisworks and usBIM.Checker. Criteria for selection of the tools was based on the fact that: they are widely used in the model checking; they address various aspects of model validation and they offer users the flexibility to create customized rules for meeting specific requirements.

Revit Model Checker, unlike other standalone tools is a plugin designed for model checking within the Revit environment. It is directly integrated in the Revit workspace allowing seamless verification process without the need for external software. It is aimed for performing different type of verifications.

Solibri is one of the most widely adopted tools for BIM model checking. It provides wide range of verifications, addressing different aspects of BIM model quality. It encompasses not only geometrical and spatial checking, but alphanumerical and code validation as well. It is mainly used for checking IFC files.

Navisworks is another widely used tool. It is focused on model coordination and clash detection. It supports wide range of file formats, so can be used for checking both Revit and IFC files.

usBIM.Checker is relatively newer addition designed for verifying properties and data content within the BIM models. It is specifically designed for checking the IFC files.

Table 4 – Selected tools information overview

Revit Model Checker	Solibri	Navisworks	usBIMChecker
Autodesk	Solibri, Inc.	Autodesk	ACCA Software
Free Tool within Paid Software	Paid Tool	Paid Tool	Paid Tool
Plugin within Revit environment	Individual software	Individual software	Individual software
File formats: Revit	File formats: IFC, IFCzip, Solibri native (SMC, SMV, SMCT), DWG	File formats: IFC, RVT, 3DS, FBX, STEP, STL, Naviswork native (NWF, NWC, NWD)etc.	File formats: IFC

2.5.2. Templates and Functionalities

Each of the selected software's has a template file containing a list of rules. Majority of users actually use only functionalities within these predefined rules as it is the simplest and fastest way to perform model checking. Limitations with using these templates is that they provide more generic type of checking and usually cannot satisfy all of the project specific requirements.

Revit Model Checker contains a public library with more than 30 templates. Besides the rule sets embedded within the plugin, many institutions such as U.S. General Services Administration (GSA) offer their templates for model checking that can be used with this tool. Exploration of given templates showed that majority of the rules focus on the alphanumerical information, whereas geometry is seen in only a small portion, regarding the unplaced rooms and spaces. University templates are very specific in the requirements for property presence and naming conventions, whereas Revit templates deal more with the requirements that assure more efficient working process. In project specific scenarios, majority of templates is not fully applicable because of their level of specificity, so the solution is in their configurability. It offers the user possibility of selection which rules from the template are going to be performed, omitting the unwanted ones from the process. This enables aligning the tool more closely to project specific requirements. In summary, for a comprehensive BIM model checking, the user would have to combine rules from different templates, enabling both alphanumerical and geometrical checks to be performed.

Solibri offers large repository containing different type of rule sets. These rules are organized according to disciplines and types of checking, although this structure can cause a slight confusion for the user. For example, the criteria that applies to all elements, such as rule concerning Global unique Identifier (GUID), is contained within Architectural checking. Majority of rules are focused on geometrical accuracy of the model, though there are rules concerning the alphanumerical requirements, such as required property sets for Mechanical, Electrical & Plumbing (MEP) elements. Similarly, to previously mentioned tool templates, some of the preconfigured rules are very specific in defining values, which can be an issue if they collide with specific project requirements. Nevertheless, Solibri allows adjusting these values by user.

Navisworks does not contain predefined templates, so all rules need to be created manually. It allows loading and storing the externally created files, but it is predominantly created for Clash Detection. Hence, it can be used to address certain aspects of quality, but specifying this type of checking is much more difficult comparing to other tools.

usBIM.Checker does not have integrated rules. The limitation of this checker is that it can only address alphanumerical information, allowing users to formulate their own property requirements and values. Considering this, it can be used to assure that information contained within entities comply to specified requirements, but not to evaluate the overall quality of the model.

2.5.3. Rule Creation

Revit Model Checker does not contain functionality for creating rules within the plugin itself. Autodesk provides another standalone application called Model Checker Configurator where rules can be formulated. Configurator offers three ways to configure the ruleset: Advanced Check Builder, Wizard Check Builder and Pre-built checks. For inexperienced users the easiest way is to use Wizard, since the interface is user-friendly, and process is relatively straightforward. Advanced Check Builder offers possibilities of formulating more complex rules, whereas pre-built section contains already defined rules that can be included into the set. Big advantage of using configurator is that Autodesk provides sample files that can be easily modified to fit the user's needs.

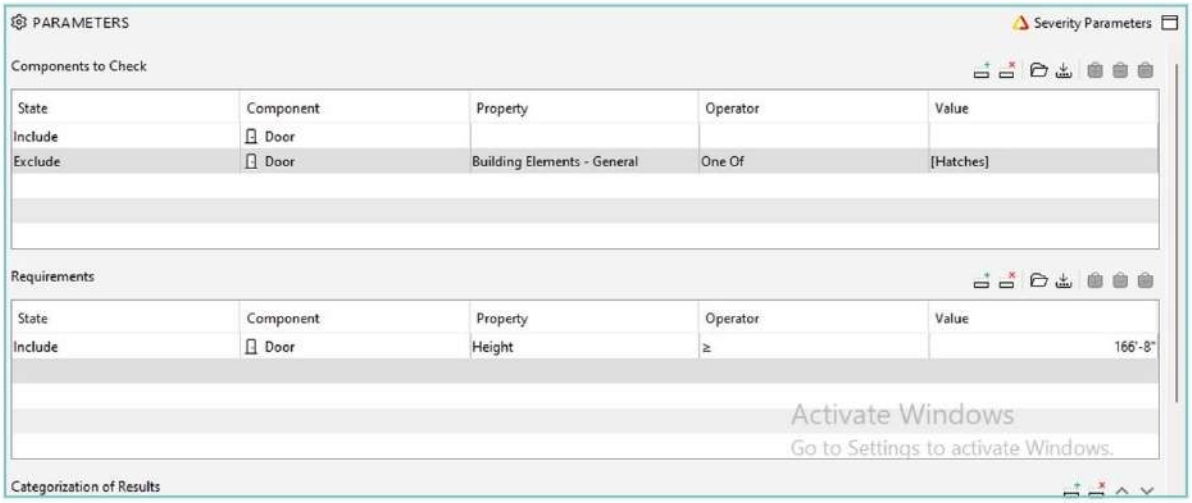
Solibri offers Ruleset Manager which users can use to customize existing or create their own rule sets. It provides separate libraries containing different type of rules that can be used as templates and modified by users or enables creating the rules from start. The process of creation is more complicated comparing to the Configurator but allows formulating more complex rules. Additionally, rulesets are automatically updated into the checking environment, and can be assessed from there as well, with any changes saved automatically to Rule Set Manager.

Navisworks offers two possible approaches to performing checks, either by Find Items or using Clash Detective. Find Items functionality allows performing alphanumerical check, since it can be used to check if there are entities that contain certain property value. Nevertheless, using this approach can be very time-consuming especially if the model contains large number of entities. Geometrical checking can be performed by Clash detective, but only to certain extent. It can be used to check elements intersection or duplication, but not more complex checking such as clearances. The process of creating rules within Navisworks is relatively easy, but since its main functionality is to detect clashes, possibilities of detecting other quality issues are very limited.

usBIM.Checker provides a functionality for checking properties and their values. Unlike previously evaluated tools which share the common logic of formulating rules, this tool functions similarly to IDS editors. It provides two sections, one where the evaluated entities are filtered and the other where property values are specified. It allows limitless possibilities when it comes to checking the content of the properties, but almost none in terms of other quality aspects, even the alphanumerical e.g., duplicated room naming (Figure 12).

Revit Model Checker:

Solibri:



Navisworks:

usBIMChecker:

Figure 12 - Door Height rule creation in the analysed tools

2.5.4. Visualization of results

Revit Model Checker displays results as a summary of the overall verification with a list of all the checking's and their results. A report shows a total count of passed and failed verifications with an overall percentage. Additionally, with each failed rule it provides a list of elements and their name and ID, enabling their identification. Along with that, it enables showing the issue directly in the model,

allowing easier navigation and tracking the issue. Verification report can be exported as a HTML or Excel file (Figure 13).

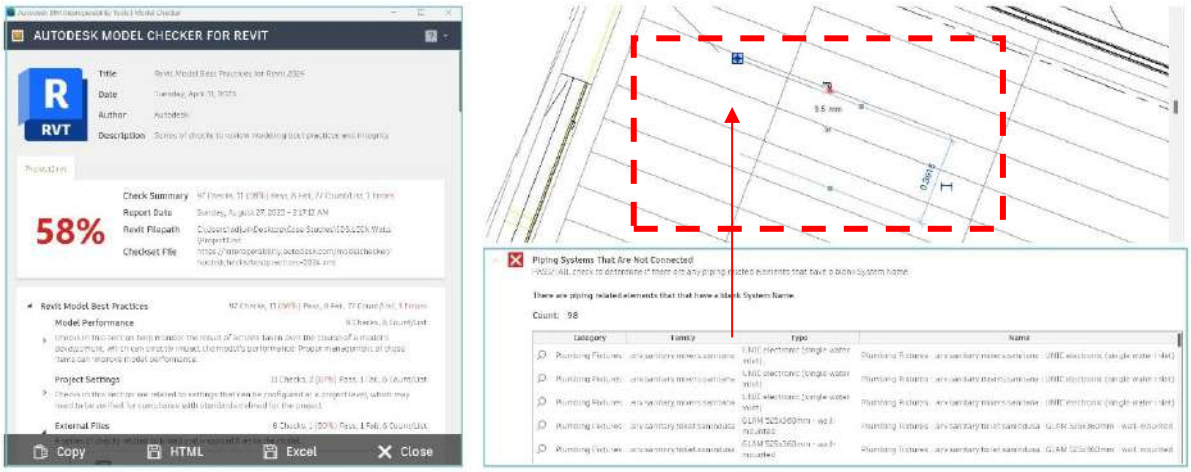


Figure 13 - Display of verification results by Revit Model Checker

Solibri shows results in checking environment as a list of verifications with a mark of their severity. It provides an extended description of failed results, classifying them in four categories: rejected, low, moderate and critical severity. Furthermore, it provides an issue count and density, as an additional measure of quantifying, as well as their visualization. The disadvantage of the way Solibri display results is that it does not provide additional data about elements which would enable their identification within proprietary software. It allows exporting the report to PDF, Excel or RTF format, as well as creating BCF (Figure 14).

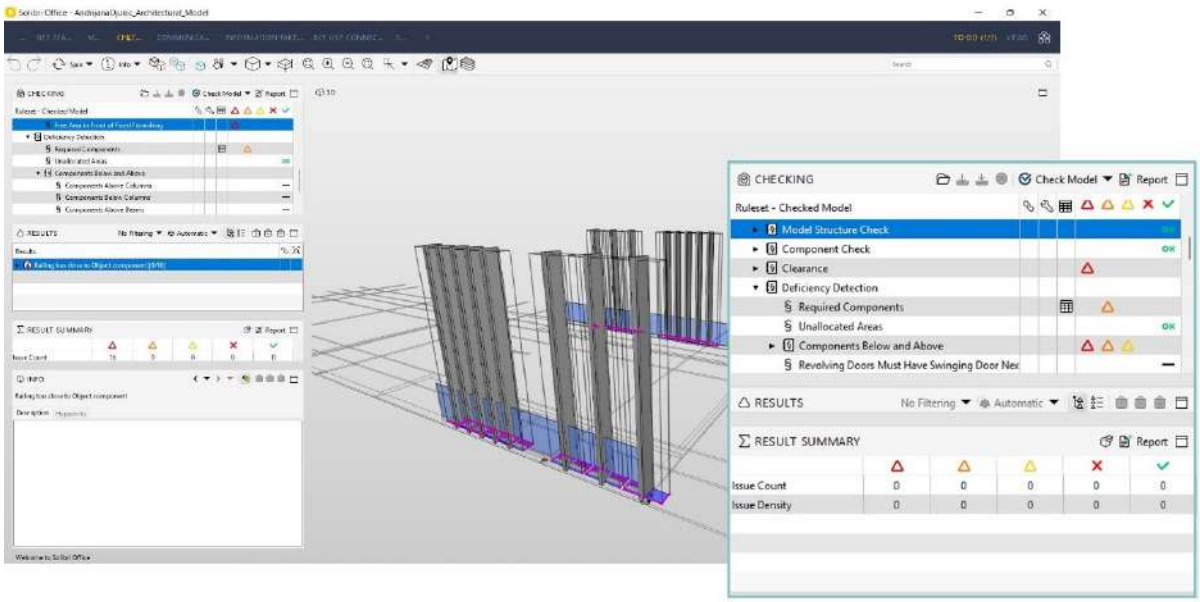


Figure 14 - Display of verification results by Solibri

Navisworks primarily uses Clash detective to display results, though other methods are possible as well. It parses the results by elements, listing the failed checks along with their description. Additionally, it

highlights the elements within the 3D viewer providing visualization of the issues. Exporting the report allows user to select which information should be exported, as well as report type and format that can be HTML, XML, text or viewpoints (Figure 15).

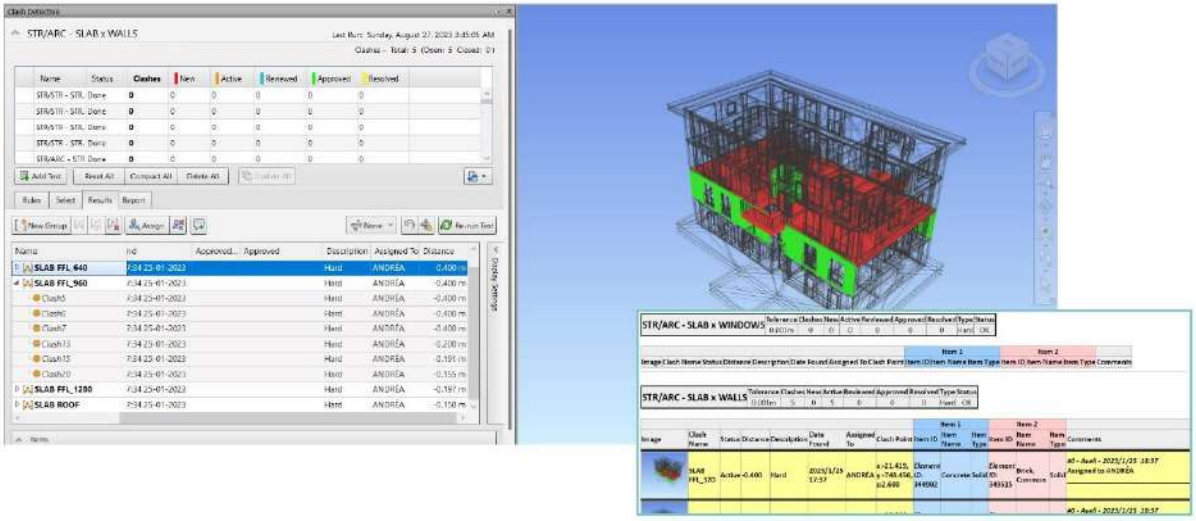


Figure 15 - Display of verification results by Navisworks

usBIM.Checker displays results in the checking environment, providing a list of failed elements along with their identification data. With a selection of each check, it highlights the element within the viewer. It allows exporting the report as Comma Separated Values (CSV), BIM Collaboration Format (BCF) or Excel (Figure 16).

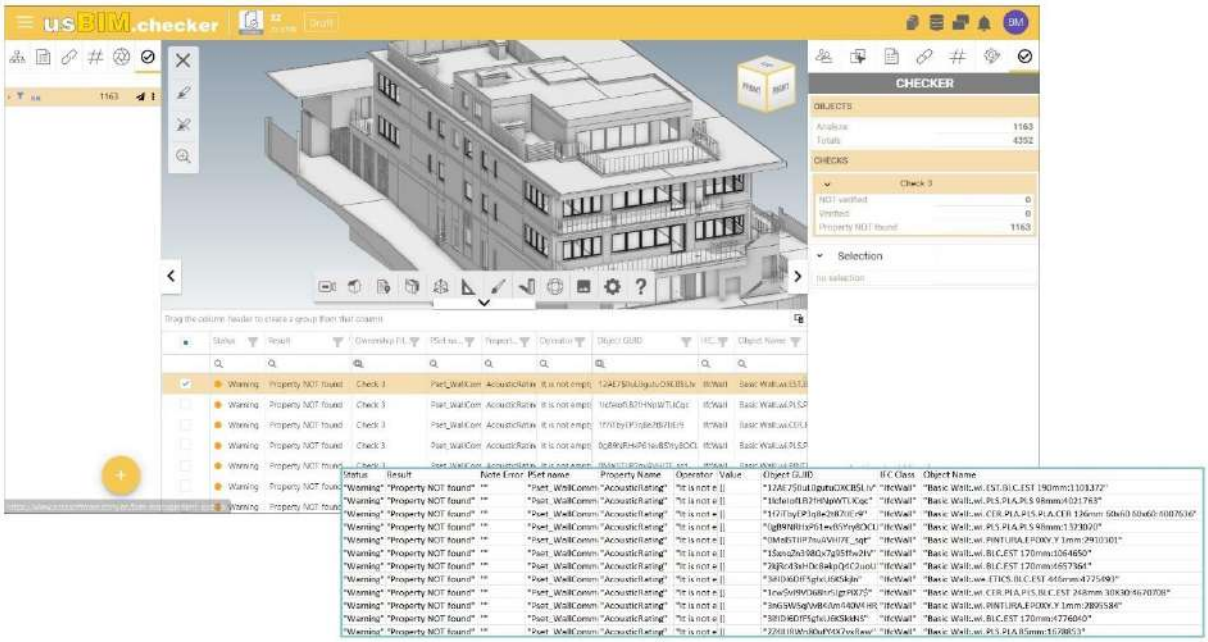


Figure 16 - Display of verification results by usBIM.Checker

2.5.5. Comparison of the selected tools

Evaluation of selected software tools provided several conclusions. Regarding the type of data that can be assessed, Solibri demonstrates great versatility, handling various checking's relatively easy. On the other hand, Revit Model Checker shows limitations in dealing with certain aspects of geometry checking such as intersections and distances. Navisworks can be used to address both alphanumerical and geometrical checks, but it is limited, and creation process is time consuming and very complex. As already mentioned, usBIMChecker deals only with property content. Downsize of rule creation process for Revit Model Checker is that it cannot be done within the plugin, but requires a separate Configurator. Nevertheless, process of creation is very straightforward, especially using the Wizard. Furthermore, it addresses issues within proprietary platform, avoiding the time-consuming export to IFC. In contrast, Navisworks offers compatibility with large range of file formats. When it comes to visualization of the results, all tools offer more or less same possibilities along with the export of reports.

In the table below (Table 5) results and conclusions of conducted study are visually displayed addressing several investigated aspects. Three levels are used for evaluation: low, medium and high.

Table 5 - Results of the evaluation of selected tools

Low=1 Medium=2 High=3

Functionality	Revit Model Checker	Solibri	Navisworks	usBIMChecker
Geometry Checks	Low	High	Medium	x
Clash Detection	x	High	High	x
Alphanumerical checks	High	High	Low	Low
Parameter value checks	High	High	Low	High
Naming Conventions	Medium	High	x	High
Classifications	High	High	Low	Medium
Building Code checks	Medium	High	x	x
Simplicity of rule creation process	High	Medium	Low	High
Complexity of rules	Medium	High	Medium	Medium
Visualization of results	High	High	Medium	High

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3. METHODOLOGY

The research on Quality Assurance and Checking of the BIM model led to several conclusions. Among the many discussions on this topic, a common thought is shared, and that is the connection of consistency and accuracy of the model data with its quality. Addressing this idea, in order to enhance the quality of the company's deliverables, it is crucial to understand what the causes of discrepancy are. A recurring thought becomes apparent: model quality is directly connected with the initial definition of the requirements. Reflecting on the earlier defined hypothesis, that the quality is conformance to requirements, brings out the obvious need to properly address them.

In many interviews conducted with company's professionals, one of the repetitive issues they all reflected on, was that clients often struggle how to explain what their needs are. They provide required documentation for information requirements, but it is often copied from project to project, not actually fitting current use. These poor inputs lead to the output of lower quality. The consequences of wrongly defined and insufficient requirements are multiple: miscommunication among involved parties, design errors, absence of valuable information etc. This results in further delays and deficiencies, affecting the quality of the whole process.

This confirms the need for creating the methodology that would facilitate seamless data specification and delivery. The aim is to handle the process of requirements specification, reducing misunderstandings and overcoming the usual challenges.

3.1. Overview of Proposed Methodology

Proposed methodology integrates QA and QC processes in the following way: firstly, addressing QA through creating a Requirements Specificator that would be used as a guideline for specifying BIM model requirements, and secondly, addressing QC through the BIM Model Verification process.

The appointing party would create a subset of requirements from the Specificator, adapting it to the personal needs, making a subset of requirements specific for the project. Created requirements are then given to the appointed party. Using the directions given in the requirements, appointed party creates the model. This model is then exported to the IFC format, used for the exchange between the parties. Then the process of backward engineering is facilitated. The created IFC file is then returned to the appointing party. When the client receives IFC file, the verification is conducted. Verification process includes checking if the delivered IFC file complies to the requirements given by the appointing party. Proposed methodology encompasses cyclical process. It starts with specifying the requirements, moves on to using those requirements for creating the model and then verifies the model to previously specified requirements (Figure 17).

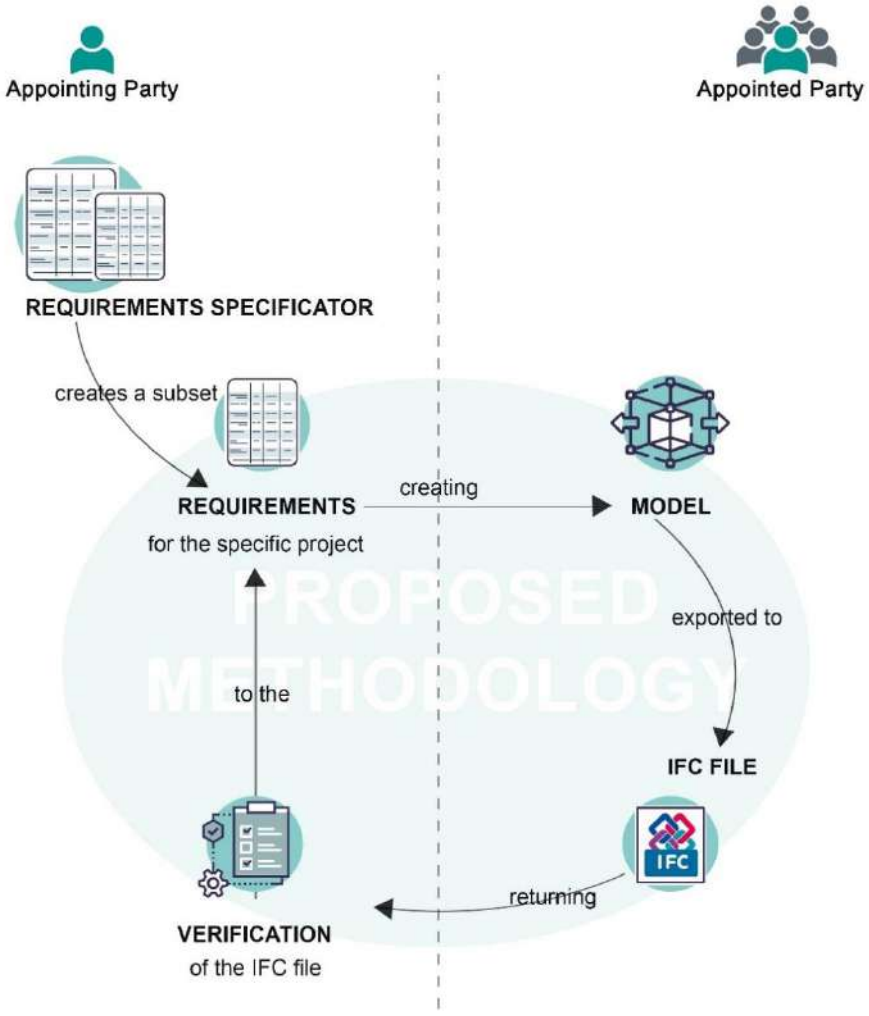

Figure 17 – Illustration of proposed methodology

3.2. Machine to machine interactions

One of the main ideas encompassing the created methodology is that it should answer the current and future industry tendencies. This concept is aligned with the principles elaborated in the previous overview on the topic of quality in Industry 4.0. As elaborated in the research addressing Quality 4.0, traditional processes of quality assurance and checking should be elevated using advanced technologies, particularly automation. Translating this vision into the methodology, the potential for automation of the requirements creation and validation is recognized. The key element in facilitating automation would be the Specificator, which would represent central repository. This repository would include all essential rules and requirements, from which the tailor-made requirements would be generated to match project specific needs. Subsequently, it would be used in the process of verification, where the compliance of the model to the requirements would be done using automated mechanisms. Having this in mind, the strategy for Specificator creation is that it supports the possibility of machine-to-machine interaction. This means it embodies a higher level of complexity compared to the conventional formats currently used. It encompasses large number of parameters that answer to the requests of machine-to-machine complexity. It is structured in tabular format, providing clear and consistent structure. This allows easy

identification and processing of the data using automated scripts and algorithms. Further, it allows creation of database which would serve as a repository of the information.

3.3. Implementation of proposed methodology

Implementation of the proposed methodology is currently directed towards two core aspects:

Development of the **Requirements Specificator** and Testing **Verification methods**.

In close collaboration with the BIMMS company, a case study was conducted on an ongoing project. The primary goal at this stage was to create the Requirements Specificator. The focus during the creation was to put on the defining modelling requirements and model content. Various industry and company specific requirements were acknowledged. Following the methodology process, this framework was then used for creation of the requirements for the specific project. Simultaneously, the possible verification methods were tested out. Based on the rules outlined by the requirements, company developed a building model. Once the model was ready, it was exported to the IFC file format. Then the verification process was conducted. In agreement with the company, it was decided to test three possible approaches of validation: one method focused on the internal evaluation of the quality, that would be performed on the company's side, and two external verification methods, that would be done by the client. The aim of the verification process is to confirm the model's compliance to the predefined requirements (Figure 18).

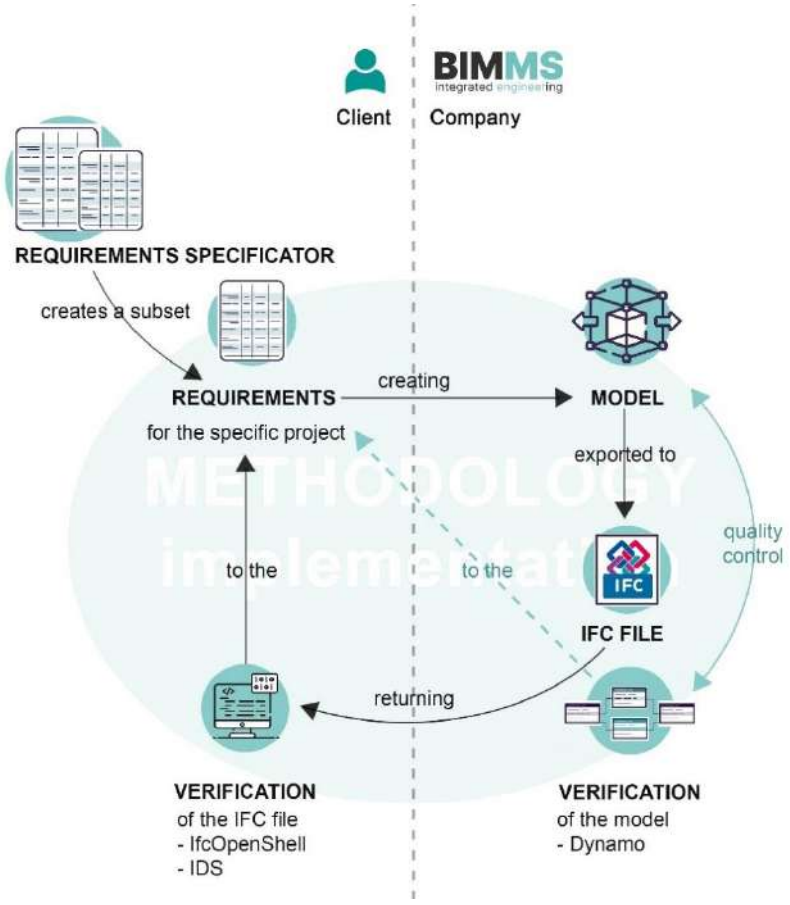

Figure 18 – Illustration of methodology implementation within the company

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4. REQUIREMENTS SPECIFICATOR

The developed Requirements Specificator demonstrates a versatile applicability and is used to assist several topics in the BIM process. To provide the guidance to the client in specifying information requirements – assuring the provision of relevant and appropriate level of information, needed to execute certain BIM Use. Serving as a modelling guide to the team members – providing precise and standardized instructions that enable consistent approach to modelling by all collaborators, not only assuring quality of the BIM model but enhancing overall efficiency. Constituting rule sets – enabling model evaluation and checking the compliance to the established requirements.

4.1. Methodology for creating the Requirements Specificator

Creating the Requirements Specificator was based on the process that included several steps in collecting and filtering the data (Figure 19).

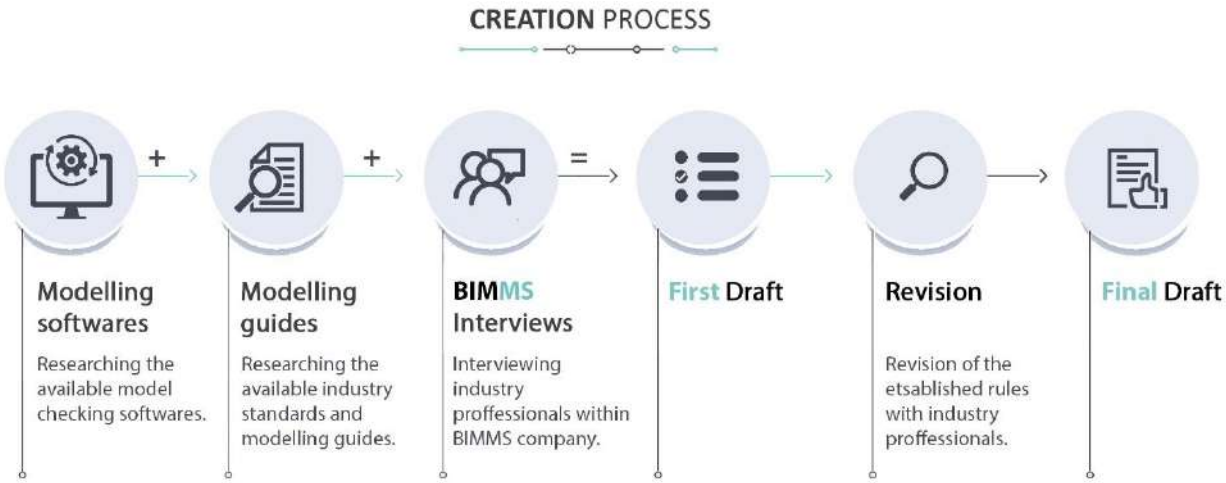

Figure 19 – Process of creating the Requirements Specificator

Ruleset creation involved methodological approach consisting of research and filtering viable information. Preliminary phase included evaluation and testing out various BIM model checking software applications and functionalities within them. Accompanying step included research through the available guides and standards covering the topic of BIM model quality and modelling overall (Table 6). Following this, next stage included the interviews with the industry professionals within the BIMMS company about the issues related to information requirements and quality of the BIM models. After collecting the data, it was formulated in the rulesets that were finally again revised and filtered with the professionals from the company.

Process of defining information content of the Level of Information Need followed the same methodology, with additional step of researching the IFC4 Schema, available MVDs and parsing through property sets for each of the elements. Finally, defining modelling rules and information content for specific BIM Uses relied a lot on the research of usual practice within industry and the company, as well as requirements of the software's used for conducting analysis.

Table 6 – List of used guides and tools

Framework Tier	Analysed Guides and Manuals	Technical documentation and specification	Tested Tools
I tier: General Project Requirements	GSA BIM Guide (2016)	IFC 4 Schema ICC-001 Design to Code Compliance Checking (ICC 2006)	Revit Model Checker Solibri Navisworks usBIM.Checker
	BIM Essential Guide (2013)		
II tier: Alphanumerical Requirements Geometrical Requirements Design Specific Requirements Level of Information Need	NATSPEC National BIM Guide (2022)		
	Singapore BIM Guide Version 2.0 (2013)		
	COBIM Series 3: Architectural Desing (2012)		
	COBIM Series 4: MEP Design (2012)		
	COBIM Series 5: Structural Design (2012)		
	COBIM Series 6 Quality Assurance (2012)		
	COBIM Series 12: Use of models in facility management (2012)		
	COBIM Series 13: Use of models in construction (2012)		
	Statsbygg BIM Manual 1.2.1 (2013)		
	GSFIC BIM Guide Series 01 (2013)		
	The New Zealand BIM Handbook (2019)		
	CIC BIM Standards General (2021)		
	e - Submission Guideline Mechanical, Electrical, Plumbing (2011)		
	Revit MEP 2011 User's Guide (2011)		
	DDC BIM Guidelines (2012)		
	BS EN 17412-1:2020 (2020)		
	Level of Development (LOD) Specification for Building Information Models (2021)		
III tier:			
Cost Estimation	COBIM Series 7 Quantity take-off (2012)	GSA-004 Architectural Design to Quantity Takeoff for Cost Estimating (2011)	Bexel
	BuildingSMART Quantity-Take-off IDM (2020)		
	RICS new rules of measurement NRM 2: Detailed measurement for building works (2012)		
Energy Analysis	BIMSpeed Analysis of BIM-to-BEM critical parameters and recommendations to solve the current bottlenecks (2019)	BuildingSMART "Technical Report for BIM-BEM Workflows" (2022) GSA-003 Architectural Design to Building Energy Analysis (2011) NOW-001 Nordic Energy Analysis (2011) HUT_HVAC-001 Indoor climate simulation to HVAC design(2010) HUT_HVAC-002 Space Requirements and Targets to Thermal Simulation (2008)	Green Building Studio Insight DesignBuilder Energy Plus CYPETHERM E Plus
	BIM application D4.3 Development and advanced prefabrication of innovative, multifunctional building envelope elements for MOdular REtrofitting and CONNECTions (MORE-CONNECT) (2017)		
	COBIM Series 10: Energy Analysis (2012)		
	GSA BIM Guide 05 - Energy Performance (2015)		
	BIM + Building Performance Analysis Using Revit 2014 and IES Virtual Environment (2014)		
	Implementation Guide: Space Boundaries for Energy Analysis (2009)		
	Dynamic Energy Optimization with Revit® and Insight 360 (2017)		
	Comparison of Building Energy Modeling Programs: HVAC Systems (2013)		

4.2. Requirements Specificator Structure

Requirements Specificator was constituted following the principles of class hierarchy inheritance. In other words, child classes inherit rules and functionalities from their parents' class. The organization of classes is structured into three distinct tiers, each serving specific groups within the Requirements Specificator (Figure 20).

I tier:

- General Project Requirements;

II tier:

- Alphanumerical Requirements, Geometrical Requirements and Design Specific Requirements;

- Level of Information Need;

o Architecture;

o Structure;

o MEP;

III tier:

BIM Uses:

- Cost Estimation;
- Energy Analysis.

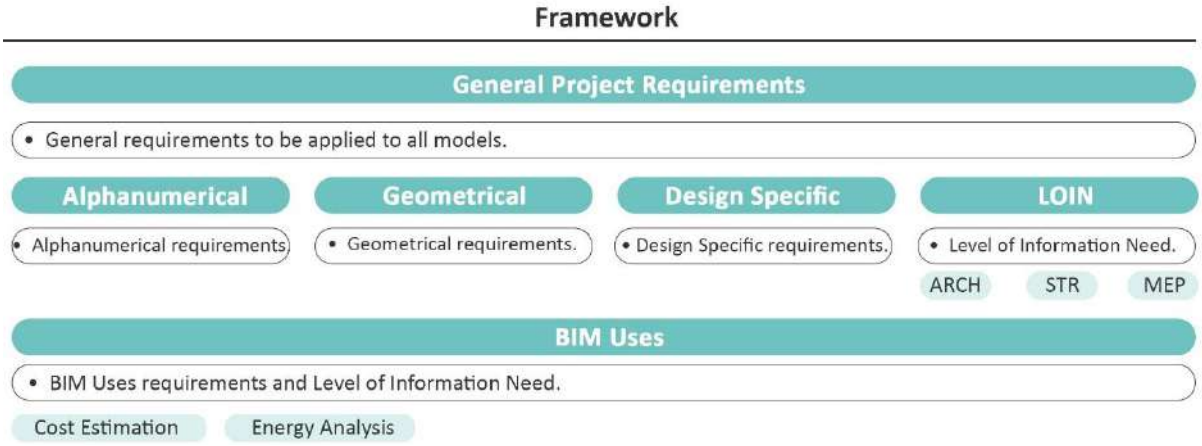

Figure 20 – Requirements Specificator Structure

First tier acts as a parent class in the hierarchy, so it captures fundamental rules and functionalities that are applicable across the entire Requirements Specificator. Moving to the second tier, classes are organized thematically, where each is focused on specific aspect within the BIM modelling. They inherit rules from the higher tier, further processing and expanding their functionalities to domain-specific requirements. Finally, third tier incorporates rules from both previous tiers, omitting and adapting the ones needed to assist provided uses.

Using hierarchical structure enhances conceptual understanding of the Requirements Specificator and enables easier navigation for the users. This contributes to better utilization and interpretation of the guidelines. Additionally, tiered design supports variety of applications and possible scenarios, allowing users to modify it according to their specific needs.

4.3. I tier: General Project Requirements

As its name suggests, first tier embodies general requirements that should be satisfied on a project level. It provides requirements for all stakeholders, assuring efficiency, consistency, and unification across all model disciplines. The primary purpose of this set is to facilitate interoperability and information exchange among different team members. In order to achieve this, requirements are constructed around

critical aspects of model exchange, addressing several key topics such as file naming convention, georeferencing, consistency of units and use of linked files.

This tier specifies following rules:

1. **Agreed Version** – *All models shall be modelled in the same version of the required tool.*

2. **BIM File Naming** – *All files within the project shall follow uniform and consistent naming convention specified by the information requirements. * If not requested otherwise, the ISO 19650-2 naming convention may be followed.*

3. **Classification System** – *All elements shall be assigned classification code and follow the same classification system e.g., Uniclass 2015.*

4. **Unique GUIDs** – *All components shall have unique GUID values.*

5. **Project Information** – *Project Information shall be defined: Project Name; Project Adress; Project Number ID, Client Name; Author.*

6. **Project Units** – *Relevant measurement units shall be defined at the Project level of each model. Metric system is used unless required otherwise.*

7. **Consistency of units** – *All discipline models shall follow the same measurement system.*

8. **Measuring accuracy** – *Measuring accuracy shall be defined on project level. If not requested otherwise, default project units should contain two decimal places.*

9. **Correct use of entities** – *All elements shall be modelled using correct tools and objects e.g., flat roof modelled with roof object, not slab.*

10. **Geographic location** – *Geographic Location shall be obtained from Survey Point. *Getting Geographic Location from Survey Point is more reliable than using Project Adress.*

11. **Survey Point** – *Survey Point shall refer to the true coordinates / real world location of the project. The location of the Survey Point shall be the same for all discipline models.*

12. **Project Base Point** – *Project Base Point shall define the origin (0,0,0) of the project coordinate system. The location of the Project Base Point shall be the same for all discipline models.*

13. **Orientation** – *Project North in all discipline models shall be the same. True North direction in all discipline models shall be the same. Angle between Project North and True North shall be the same in all discipline models.*

14. **Level structure** – *All models shall use the same level structure.*

15. **Grids –** *Grids shall be consistent across all discipline models.*

16. **Unused Elements** – *Models shall not contain unused elements.*

17. **Linked Revit files** – *Linked Revit Files shall be pinned in place.*

18. **Linked CAD files** – *Linked CAD Files shall be pinned in place.*

19. **In-Place Families** – *Using In-Place Families should be avoided.*

Each of the listed requirements carries a rule specification defining what needs to be followed. All rules are constructed following schema:

- The word "**shall**" express a requirement that must be followed strictly;
- The words "**should**" and "may" express recommendation as a valuable guidance;
- The word "**can**" express possibility that can be explored.

One requirement can be constructed using combination of different expressing ways, where "shall" defines a requirement and "should" is used as accompanying recommendation, as shown in the example below (Figure 21).

8	Measuring accuracy
	Measuring accuracy shall be defined on project level.
	If not requested otherwise, default project units should contain two decimal places.

Figure 21 - Example of rule specification, I tier: General Project Requirements

Having in mind that majority of these aspects is typically defined by the client and tailored to the specific project requirements, rules are accompanied by annexes of recommendations that may be followed. These annexes are based on the ISO standards, or in case where there is no standard on the topic, company professionals' advice. In the example of File Naming rule provided below (Figure 22), rule states that: "All files within the project shall follow uniform and consistent naming convention specified by the information requirements". Annex to the rule is a BS EN ISO 19650-2 Naming Convention that may be followed or serve the client as a guide for specifying file naming standard.

2	BIM File Naming
	All files within the project shall follow uniform and consistent naming convention specified by the information requirements.
	* If not requested otherwise, the BS EN ISO 19650-2 naming convention may be followed.
	Project Code><Originator<>Functional Breakdown<>Spatial Breakdown<>Form<>Discipline<>Number
	Project Code – individual code for the project e.g., SC1
	Originator – unique code for the organization creating information e.g., SFT
	Functional Breakdown – design purpose of the information e.g., fire protection information
	Spatial Breakdown – spatial location of information e.g., first floor building level 01
	Form – defining form of information
	D-drawing
	G-diagram
	I-image
	L-list
	M-model
	T-textual
	V-video/audio
	Discipline – technical activities
	A-Architecture
	B-Building surveying
	C-Civil engineering
	D-demolition/dismantling
	E – Electrical Engineering…
	Number – used for differentiation by allocating a sequential number
	*General rules
	Avoid using special characters in fields and folders \ / : * ? " < > | [ ] & $, . { } @
	All fields shall be separated by a hyphen character.

Figure 22 - BIM File Naming, I tier: General Project Requirements

4.4. II tier:

As explained previously, this tier dives into details of modelling requirements identified by the industry standards and BIMMS company professionals. Main goal is twofold: first, to address repetitive quality issues and enhance overall model quality and secondly, to improve the exchange process between the parties. It addresses two key aspects which are:

1. **Modelling requirements**:

- Alphanumerical;
- Geometrical;
- Design specific;

2. **Model content**:

- Level of Information Need – Architectural elements;
- Level of Information Need – Structural elements;
- Level of Information Need – MEP elements;

As shown above, the model requirements section is divided into three categories: alphanumerical, geometrical and design specific requirements, where each of them embodies a set of rules that address

certain aspects of the model quality. Alphanumerical requirements involve detailed instructions regarding the information contained within the BIM model and the way that information is structured. On the other hand, geometrical requirements delve into geometrical representations of objects and their relations. Design specific tier addresses very specific requirements that are related to the practice currently followed within the company.

The model content section can be seen as an addition to alphanumerical requirements. It is aimed at providing clear information about which data should be contained within which element.

4.4.1. Alphanumerical Requirements

Alphanumerical requirements ruleset delves into the topic of naming conventions and consistency within the model. It provides systematic way of the labelling and categorization of elements and other data, assuring efficient data management inside and in between the models.

The research conducted within the company showed that large portion of quality issues appear due to lack of standardization and consistency, particularly in the naming domain. Usually, naming is addressed only to a certain extent such as naming the levels and objects. This deficiency leads to a lack of uniformity within the elements essential for collaboration of different parties e.g., views and callout views.

Furthermore, the modelling process faces major drawbacks due to inconsistencies in property naming and values. While this does not manifest as an issue during the modelling process, it can pose a significant difficulty in providing specific BIM uses. Notably, process of QTO is considerably influenced by this topic since it relies on the use of parameters for extracting certain elements or their values. Meaning that inconsistencies and lack of unification in this field, slow down the process significantly. Having this in mind, created alphanumerical requirements address three critical aspects:

Naming – Standardization and consistency of naming as facilitator of interoperability.

Properties – Uniformity of property naming and values as paramount for optimizing processes and BIM functionalities.

Consistency of data – Maintaining data consistency for providing uniform and reliable information.

Requirements are specified as follows:

1. **Level Naming** – *All levels shall follow a uniform and consistent naming convention specified by Information requirements. If not requested otherwise, ISO 19650-2:2018 may be followed: Using a two-digit sequential numbering system.*

2. **View Naming** – *View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements. If not requested otherwise, View Naming may follow the schema: Level (Optional)<>Content*

3. **Callout View Naming** – *View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements. If not requested otherwise, View Naming*

schema may be applied. If the View refers to a fabrication detail, Classification code may be applied in the naming.

4. **Object Naming** – *All objects shall follow the same naming convention specified by the Information requirements. If not requested otherwise, BS 8541-1:2012 may be followed.*

5. **Material Naming** – *All materials shall follow the same naming convention.*

6. **Property Occurrence** – *Each BIM object shall have only one occurrence of the property. *In case of duplication, hard-coded properties have precedence.*

7. **Property Units** – *All property units shall be consistent and following metric system, if not specified otherwise.*

8. **Unique Property Naming** – *Each unique information describing the object shall contain a unique property name.*

9. **Property Naming** – *Properties shall be named in consistent and human-readable way.*

10. **Property Value** – *Properties shall have defined values where known.*

11. **Unique Room Naming** – *There shall be no rooms containing the same naming code.*

12. **Space and Room Naming** – *Space and Room Naming shall be the same as the naming defined by the program.*

13. **Consistency of Levels** – *Naming of the levels shall be consistent in all discipline models.*

Each requirement specifies a rule that the model needs to adhere to. Rules are following the Shall/Should expression schema as explained in the previous paragraph, which means that each rule contains a specific requirement of what must be followed and is accompanied by recommendation that can help users in achieving it (Figure 23). Recommendations are either proposed by ISO standard, or the company's example of good practice.

1	**Level Naming**
	All levels shall follow a uniform and consistent naming convention specified by Information requirements. If not requested otherwise, ISO 19650-2:2018 may be followed: Using a two-digit sequential numbering system. ZZ - Multiple Levels XX - No Level Applicable GF - Ground Floor 0 - Base level of building (where ground floor is not appropriate) 1 - Floor 1 2 - Floor 2 M1 - Mezanine above level 01 M2 - Mezanine above level 02 B1 - Basement level 1 B2 - Basement level 2
2	**View Naming**
	View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements. If not requested otherwise, View Naming may follow the schema: Level (Optional)<>Content Level-description of the content and purpose of the view Content-further clarification of the information shown e.g., LEVEL 1-FLOOR PLAN
3	**Callout View Naming**
	View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements. If not requested otherwise, View Naming schema may be applied. If the View refers to a fabrication detail, Classification code may be applied in the naming e.g., Pr_20_65_60_17 : Cross-laminated timber (CLT) paneled module

Figure 23 - Section of Naming rules, II tier: Alphanumerical requirements

4.4.2. Geometrical Requirements

Geometrical Requirements focus on defining guidelines related to geometry, positioning and modelling of the elements. Focal point is to establish rules that would enhance overall model quality and ensure that the BIM model accurately reflects real-world objects.

In the discussions with the company's professionals, it was concluded that majority of attention given to geometrical verifications is focused on the intersection of the elements i.e., Clash Detection. While there is no doubt in the importance of detecting elements intersection, this has led to some of the foundational aspects to be neglected. For example, duplication of the same elements does not present a visual problem, hence it is often overlooked during the modelling process. This results in issues appearing during the performance of Quantity Take-offs, where this duplication produces inaccurate quantities.

Recognizing the importance of these issues, this category is focused on defining rules that address geometrical aspects of modelling that do not just affect the visual appearance of the model, but the accuracy of data provided as well. This can be illustrated on the example of the following rule (Figure 24):

6	**Elements Location - Doors/Windows**
	Windows and doors shall be assigned to the same floor as the walls or roofs in which they are located.

Figure 24 - Elements location rule, II tier: Geometrical Requirements

This rule is pretty straightforward stating that the hosted elements of the walls should be allocated to the same level as those walls. This seems like a minor detail but is a very common issue in modelling practice. The issue appears when there is a mismatch between the levels of these interconnected elements. For example, window can be hosted in the wall and assigned to the building storey 1, whereas the wall itself is associated to the upper level. They are aligned because the window is actually elevated at the height equivalent to the upper storey. Visually, everything seems in order, however there is discrepancy in the information that causes further issues with phasing and construction planning.

Addressing these issues, a subset of rules is created as follows:

1. **Published Models** – *Published models shall not contain model objects of other disciplines, even if they were used as reference.*

2. **Lost Elements** – *Element placed on distance bigger than xx in x,y,z direction from the grid borderlines shall be considered a lost element.*

3. **Duplicated Elements** – *Model shall not contain identical instances in the same place.*

4. **Mirrored Elements** – *Model shall not contain mirrored instances of loadable components.*

5. **Elements Intersection** – *Model shall not contain elements that overlap / intersect.*

6. **Elements Location – Door/Windows** – *Windows and doors shall be assigned to the same floor as the walls or roofs in which they are located* (Figure 25).

7. **Elements Location – Door Host** – *Interior doors shall be placed in interior walls and exterior doors shall be placed in exterior walls.*

8. **Elements across multiple storeys** – *Elements should not be modelled continuously across multiple storeys. *Exception: Elements that are constructed as continuous i.e. in situ poured shafts. Elements modelled across multiple storeys shall be referenced to the lowest story on which they appear.*

9. **Unallocated / Unplaced Space** – *Model shall not contain spaces that are not placed.*

10. **Redundant Space** – *There should be no spaces overlapping. Spaces shall not cross each other horizontally or vertically.*

11. **Space Modelling** – *Spaces shall be directly adjacent to surrounding walls / other space components, floor below and ceiling finish / structural slab.*

12. **Unallocated / Unplaced Rooms** – *Model shall not contain rooms that are not placed.*

13. **Redundant Rooms** – *There should be no rooms overlapping. *If there is no element to be zone boundary, room separation lines should be used.*

14. **Room Area** – *Room Area shall be the same as the area required and defined by the room Schedule.*

15. **Space Area** – *Space Area shall be the same as the area required and defined by the space program.*

16. **Sloped Floors** – *Modelling sloped floors that exceed levels continuously should be avoided. *It is advised to create independent sloped floor in each level with the meeting points of the floors being at the upper and lower edges of the levels.*

17. **Structural Elements Connection** – *Structural connections should be modelled.*

18. **MEP Elements Connection** – *There shall be no unconnected MEP elements.*

19. **Elements not within rooms/spaces** – *Instances of furniture should be located inside the room/space.*

1	**Published models**
	Published models shall not contain model objects of other disciplines, even if they were used as reference.
2	**Lost Elements**
	Element placed on distance bigger then xx in x,y,z direction from the grid borderlines shall be considered a lost element.
3	**Duplicated Elements**
	Model shall not contain identical instances in the same place.
4	**Mirrored Elements**
	Model shall not contain mirrored instances of loadable components.
5	**Elements Intersection**
	Model shall not contain elements that overlap / intersect.
6	**Elements Location - Doors/Windows**
	Windows and doors shall be assigned to the same floor as the walls or roofs in which they are located.

Figure 25 - Segment of rules, II tier: Geometrical Requirements

4.4.3. Design specific requirements

This section introduces a set of specific design guidelines that address dimensioning the elements and overall design practice that should be followed. In many cases client's directives are missing or being ambiguous, causing interoperability difficulties and moreover, causing much larger issues when it comes to fabrication of elements and on-site construction, especially when the element requires strict conformance to predefined dimensions or dimensions being dependent on the country legislative. Dimensions proposed in the Requirements Specificator align with the current practice followed within the company and are changeable depending on the project specific requirements.

This section centres on three key components: Element Size, Clearances and Good modelling practice.

While element sizing is often specified through constraints when dealing with a very distinct type of object, it is beneficial to define the range of sizes for all elements. It enhances precision and uniformity

within the model. Moreover, it enables compliance of the dimensions to the regulations defined by country's legislative.

Concept of defining clearances mirrors the same idea. It avoids issues detected during construction and follows the legislative regarding prescribed values e.g., toilet clearance (Figure 26).

2	**Clearance in front of Doors/Windows**
	Interior Doors - Minimal clearance in front of the door shall not be less than 900mm.
	Exterior Doors - Minimal clearance in front of the door shall not be less than 1200mm.
	Emergency Exit Doors - Minimal clearance in front of the door shall not be less than 1200mm.
3	**Clearance in front of the Water Closet**
	Minimal distance between axis of the water closet and compartmentation wall shall not be less than 450mm.
	Minimal distance between the front edge of the water closet and other elements shall not be less than 533mm.
4	**Entrance Landings**
	Door maneuvering clearances shall not overlap with ramp landings.

Figure 26 – Clearance rule sets, II tier: Design specific Requirements

Good modelling practice rules, in this case specified for MEP elements, integrate company's established quality procedures into the Requirements Specificator. These requirements are designed based on the quality reports of the semiconductor's company sector. They are ensuring that the modelling process is aligned to the design and fabrication requirements and preventing the issues occurring in the later stages of the project.

Rules are constructed as follows:

1. **Element Size** – *Wall height should not be less than 300mm. Window width should not be less than 100mm. Door width should not be less than 800mm. Door height should not be less than 2000mm. Staircase width should not be less than 900mm. Slab thickness should not be less than 100mm. Roof thickness should not be less than 100mm. Column profile diameter/width should not be less than 50mm. Beam profile width should not be less than 50mm.*

2. **Clearances in front of Doors/Windows** – *Interior Doors – Minimal clearance in front of the door shall not be less than 900mm. Exterior Doors – Minimal clearance in front of the door shall not be less than 1200mm. Emergency Exit Doors – Minimal clearance in front of the door shall not be less than 1200mm.*

3. **Clearance in front of the Toilet** – *Minimal distance between axis of the water closet and compartmentation wall shall not be less than 450mm. Minimal distance between the front edge of the water closet and other elements shall not be less than 533mm.*

4. **Entrance Landings** – *Door maneuvering clearances shall not overlap with ramp landings.*

5. **Minimal room height** – *Minimal height measured from the top of the floor finish to the bottom of the ceiling finish shall not be less than 2.20m.*

6. **Minimal handrail height** – *Minimal handrail height for stairs and ramps shall not be less than 900mm.*

7. **Low Points** – *Low Points should be avoided. *so that impurities would not collect in those points – ducts, drain lines, gas lines depending on type of gas.*

8. **Drainline Slope** – *Drainlines shall have slope that allows self-drainage. *minimal slope 1-100*

9. **Piping Insulation** – *Insulation type and dimensions shall be in accordance to information requirements. *Minor clashes between insulation and other elements are tolerated.*

10. **Equipment Vacuum Line** – *Equipment Vacuum Line shall follow the fastest possible route to minimize the number of bends i.e., energy loss.*

11. **Popout Sharing Criteria** – *Different tools should not share the same popout. Matrix for popout sharing* (Figure 27).

12. **Spool Pipe sizing** – *Maximum pipe length shall be 6m. Maximum pipe length with two bends shall be 3m. Maximum pipe length with more than two bends shall be 1.5m.*

13. **Layers** – *All layers and colouring shall be consistent according to information requirements.*

14. **Valve handles** – *All valve handles shall be designed to be accessible.*

15. **Routing** – *All services shall run inside their designated area defined by space management rules.*

16. **No crossing lines in fab** – *There should be no lines crossing in the technical area near the main equipment. *Main equipment surroundings should be as neat as possible.*

17. **Steel/Copper Piping Bending** – *Piping sizes ¼, 3/8 and ½ should use bending angles and not fittings. *Bends to be made in 15 degrees increment. Preferably 45° and 90°.*

18. **Line Numbers** – *Line numbers shall be assigned to the corresponding lines.*

19. **Line Numbers Naming** – *All line numbers shall follow the same naming convention.*

20. **Piping Length Dimensions** – *All piping lengths shall be rounded to whole numbers or with decimal component 0.5.*

21. **Field Connection** – *All prefab elements shall contain the marking of the location of the joints.*

11 **Popout Sharing Criteria**

Different tools should not share the same popout.

Matrix for popout sharing

	Dry Mechanical	Wet Services	Hot Duct	Heat Traced Lines	Electrical Services
Dry Mechanical	yes	yes	yes	yes	yes
Wet Services	yes	yes	yes	yes	no
Hot Duct	yes	yes	yes	yes	no
Heat Traced Lines	yes	yes	yes	yes	no
Electrical Services	yes	no	no	no	yes

Figure 27 - Popout Sharing Criteria, II tier: Design specific Requirements

4.4.4. Level of Information Need

This section serves as a reference tool aimed at enhancing data content of the elements within the model. It represents a systematic way of providing the information requirements that enables user an easier identification of data needed to be contained within the model. It is important to note that it is a foundational Requirements Specificator and should be adapted to project specific scenarios. The main idea is to form a repository of objects containing essential data for each element, enhancing the overall model content quality.

It is categorized into three main disciplines: Architectural, Structural and MEP (Mechanical, Electrical and Plumbing). Each of the disciplines contains Level of Information Need for most frequently used elements. Furthermore, a finer division is implemented within each discipline, aligning with the three primary stages of construction projects: Design, Construction, and Operation (Figure 28).

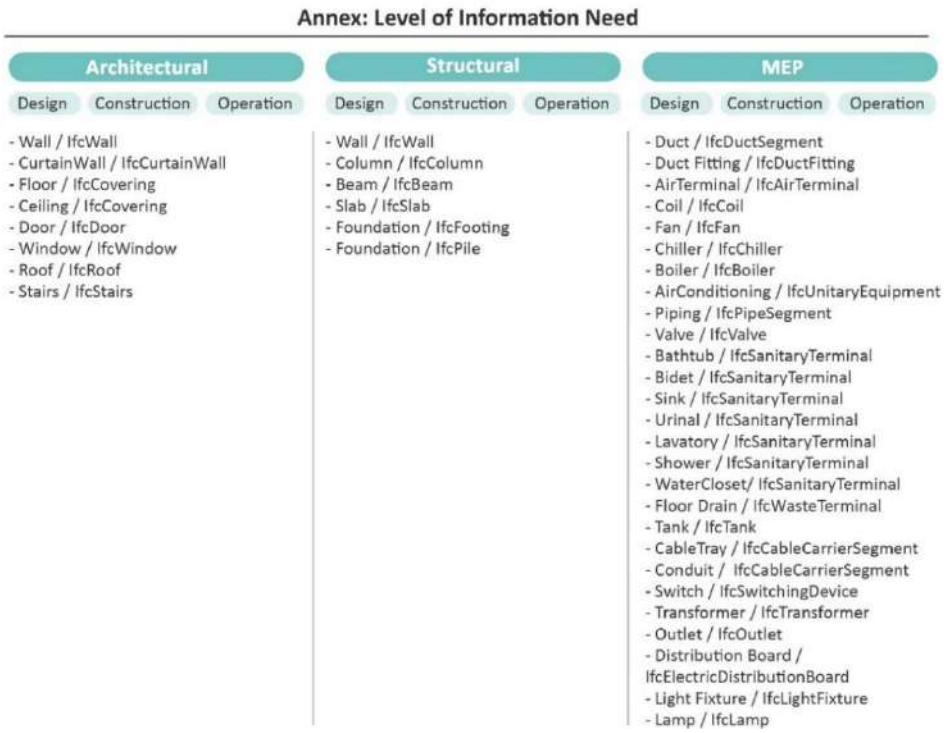

Figure 28 - Level of Information Need Structure

Method of specifying Level of Information Need aligns to the schema proposed by BS EN 17412-1:2020 (2020) standard, designing geometrical, alphanumerical and documentation requirements, as shown in an example of the Wall below (29). Full schema is provided in the Appendix 5.

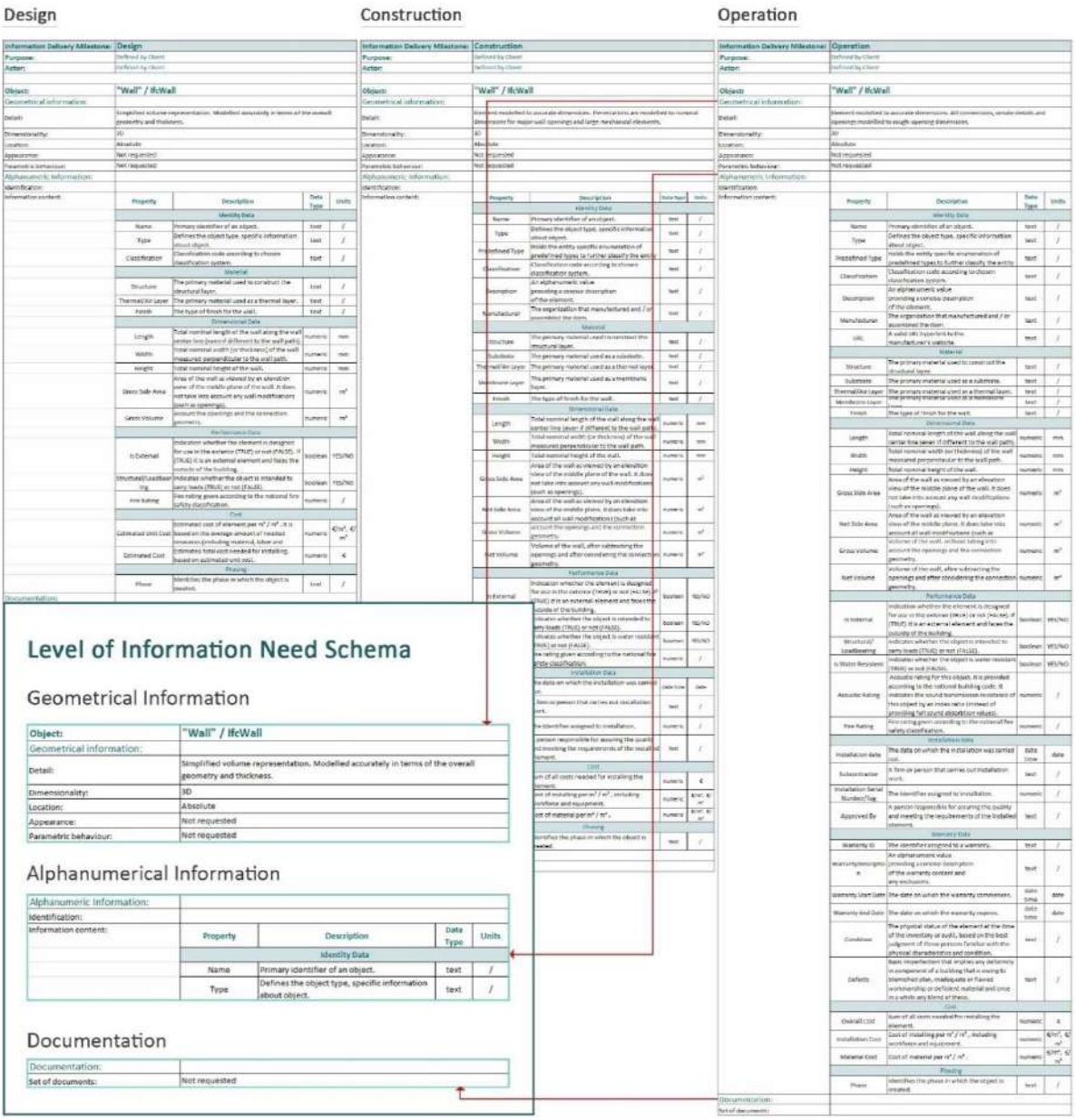

Figure 29 - Level of Information Need Schema – Example for Wall

Geometrical information defines the overall level of detail and the graphical representation of elements. It provides general guidelines on how the element should be modelled and is conditional on the delivery milestone, meaning the detail and accuracy of modelling grow exponentially with higher stages. Geometry requirements content was based on a recognized industry standard, specifically the Level of Development (LOD) Specification for Building Information Models (2021) and guides provided above.

On the section of geometrical requirements of the wall through all three phases (Figure 30) it can be compared how the level of detail changes through modelling phases. More detailed representation and higher accuracy is required in the construction and operation.

Information Delivery Milestone:	Design
Purpose:	Architecture
Actor:	/
Object:	"Wall" / IfcWall
Geometrical information:	
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.
Dimensionality:	3D
Location:	Absolute and relative to other building elements
Appearance:	Single color fill
Parametric behaviour:	Not requested

Information Delivery Milestone:	Construction
Purpose:	Architecture
Actor:	/
Object:	"Wall" / IfcWall
Geometrical information:	
Detail:	Element modelled to accurate dimensions. Penetrations are modelled to nominal dimensions for major wall openings and large mechanical elements.
Dimensionality:	3D
Location:	Absolute and relative to other building elements
Appearance:	Color fill to distinguish different materials
Parametric behaviour:	Not requested

Information Delivery Milestone:	Operation
Purpose:	Architecture
Actor:	/
Object:	"Wall" / IfcWall
Geometrical information:	
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to rough-opening dimensions.
Dimensionality:	3D
Location:	Absolute and relative to other building elements
Appearance:	Color fill to distinguish different materials
Parametric behaviour:	Not requested

Figure 30 - Comparison of geometrical information for the IfcWall in Design, Construction and Operation, II tier: Level of Information Need-Architectural

Alphanumerical information outlines data content that should be assigned to the elements. It is structured in the tabular configuration, which, as explained previously, is devised to facilitate machine-to-machine interactions. Within this construct, each parameter is accompanied by contextual description, data type it embodies and the corresponding unit of measurement. Where feasible, properties adhere to the IFC schema (Figure 31), facilitating seamless data transition process into the IFC format.

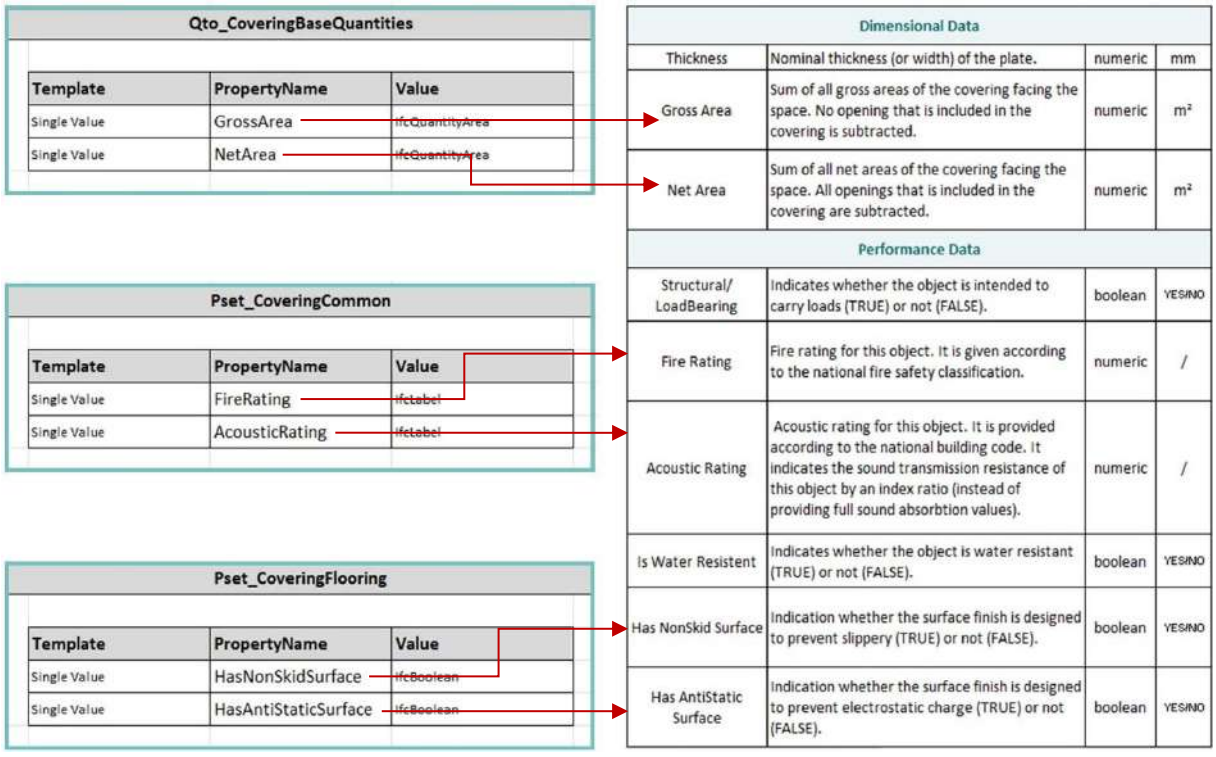

Figure 31 - Compliance to the IFC Schema, Flooring / IfcCovering

Properties are methodically grouped into sets, providing systematic organization that enables easier identification and navigation. The sets are as following:

1. **Identity Data** – providing naming and identification data of the element;
2. **Material Data** – providing data regarding the material;
3. **Dimensional Data** – providing dimensional data about the element;
4. **Performance Data** – providing data about the elements performance;
5. **Cost** – providing data about cost of the installation;
6. **Phasing** – assigning the project phase;

As the alphanumerical content of the elements also grows exponentially with construction and operation phase, more sets are added:

7. **Installation data** – providing data about the installation of the element;
8. **Warranty Data** – providing data about the warranty.

It is important to note that the progression of the project does not only influence the quantity of information content, but the content changes as well, becoming more specific and accurate. For example, in the design phase structural columns contain estimated reinforcement quantity, which is given as a rough estimation based on previous experience. Logically, in the construction and operation phase this information translates into the actual reinforcement data. The example of the IfcDoor properties shown below illustrates the exponential growth of data in different phases (Figure 32).

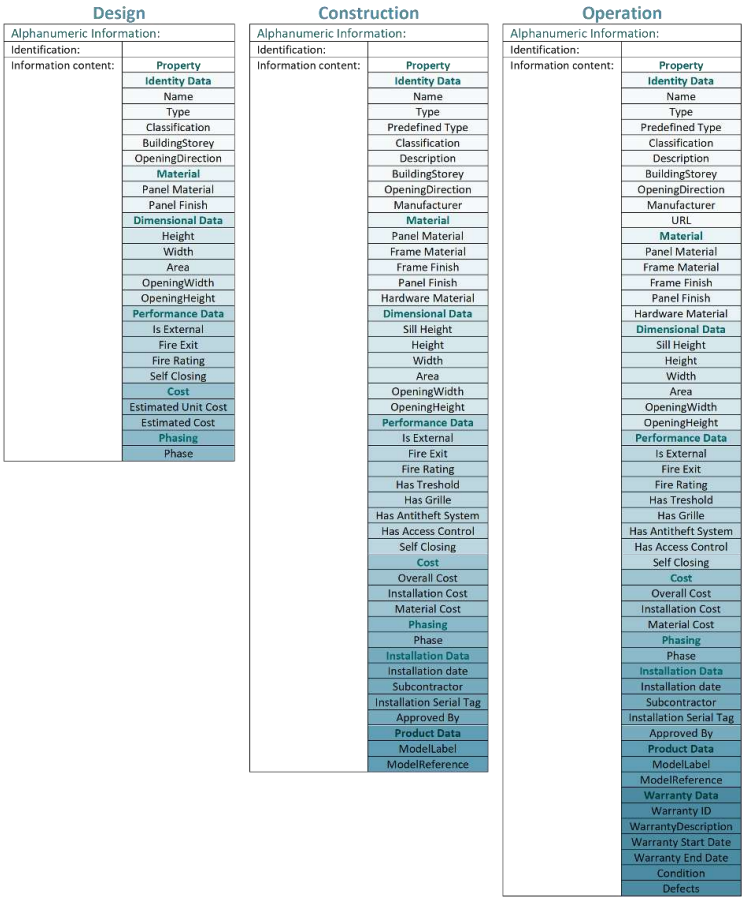

Figure 32 - Visual comparison of Information content for the IfcDoor in Design, Construction and Operation, Level of Information Need – Architectural

Created library contains 126 specifications of Level of Information Need divided by three phases for 42 elements. Each element is specified following previously explained schema for the Design, Construction and Operation phase. Elements are classified by discipline into three categories: architectural, structural and MEP. Each element accompanies a certain number of associated parameters that differs through phases (Table 7).

Table 7 – Elements and Number of associated parameters, II tier: Level of Information Need

Elements	Parameters		
	Design	Construction	Operation
Wall / IfcWall	17	30	38
Curtain Wall / IfcCurtainWall	17	27	34
Flooring / IfcCovering	15	29	37
Ceiling / IfcCovering	14	26	35
Door / IfcDoor	19	37	45
Window / IfcWindow	21	41	49
Roof / IfcRoof	20	29	37
Stairs / IfcStairs	20	33	39
Structural Wall / IfcWall	15	26	33
Column / IfcColumn (Figure 34)	17	32	39
Beam / IfcBeam	20	33	40
Slab / IfcSlab	19	31	38
Foundation / IfcFooting / IfcPile	17	31	39
Duct / IfcDuctSegment	26	37	44
Duct Fitting / IfcDuct Fitting	20	31	38
AirTerminal / IfcAirTerminal	31	43	49
Coil / IfcCoil	18	30	37
Fan / IfcFan	27	38	45
Chiller / IfcChiller	23	35	43
Boiler / IfcBoiler	22	44	50
AirConditioning / IfcUnitaryEquipment	22	34	41
Piping / IfcPipeSegment	20	31	37
Valve / IfcValve	22	33	40
Bathtub / IfcSanitaryTerminal	18	30	37
Bidet / IfcSanitaryTerminal	17	30	37
Sink / IfcSanitaryTerminal	16	30	38
Urinal / IfcSanitaryTerminal	17	30	37
Lavatory / IfcSanitaryTerminal	17	30	40
Shower / IfcSanitaryTerminal	19	32	39
WaterCloset / IfcSanitaryTerminal	19	32	39
FloorDrain / IfcSanitaryTerminal	14	30	37
Tank / IfcTank	17	27	34
CableTray / IfcCableCarrierSegment	13	21	28
Conduit / IfcCableCarrierSegment	12	21	28
Switch / IfcSwitchingDevice	16	30	37
Transformer / IfcTransformer	21	35	42
Outlet / IfcOutlet	14	27	34
Distribution Board / IfcElectricDistributionBorad	15	28	35
Light Fixture / IfcLightFixture	17	30	37
Lamp / IfcLamp	18	28	35
	742	**1252**	**1541**
			3535

The diagram shown below illustrates graphically the relationships between entities, property sets and properties within elements (Figure 33).

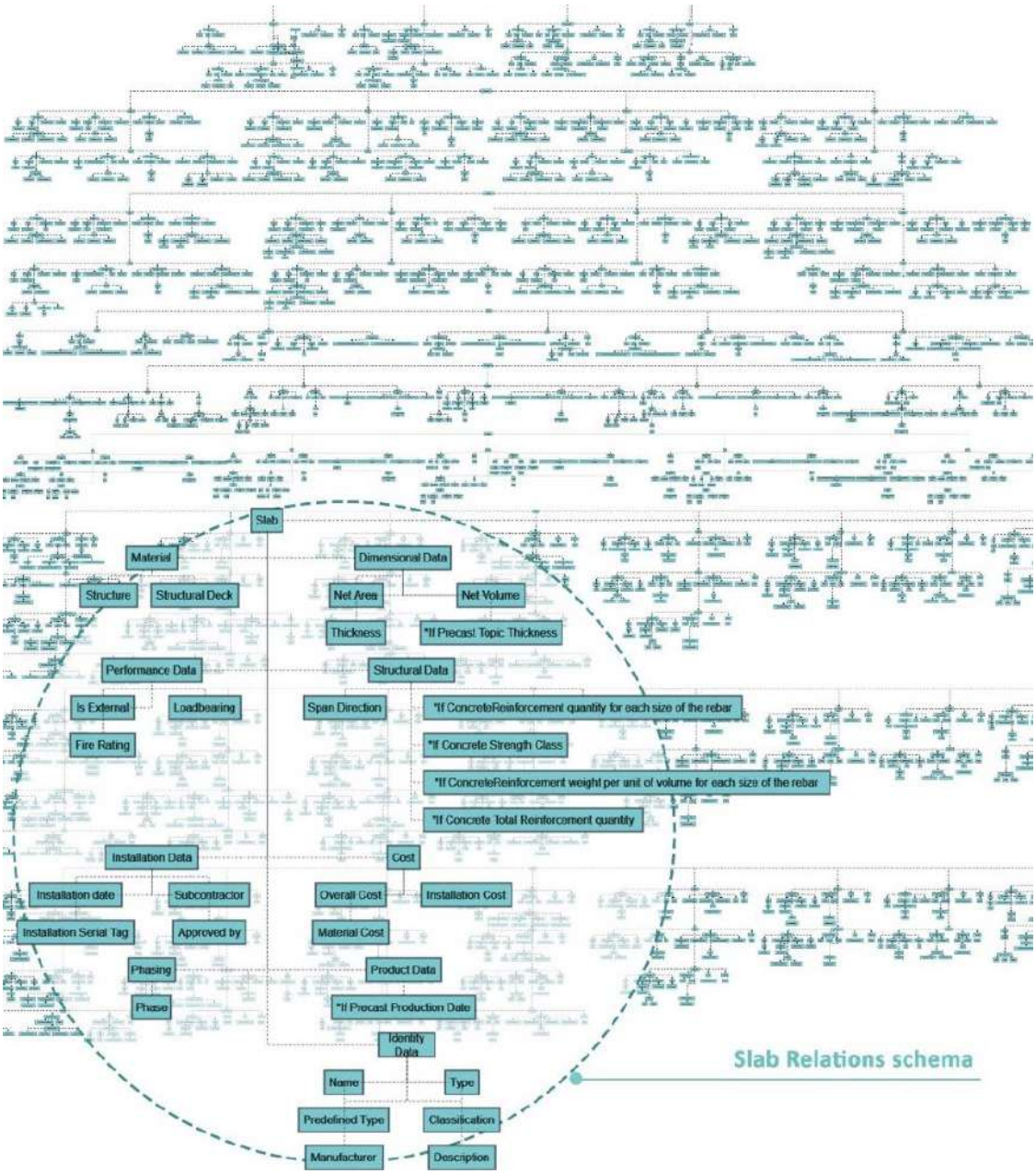

Figure 33 - Visualization of elements and parameters relations, II Tier: Level of Information Need

A key point to highlight is that each element contains data relevant to its specific type. In addition to the property sets outlined earlier, it embodies the information relevant to its discipline. For instance, structural elements contain Structural Data set (Figure 34), offering reinforcement information, while mechanical elements hold Mechanical Data set (Figure 35) where relevant mechanical content is displayed. This approach ensures that the data contained within each element is uniquely suited to its role and purpose.

Structural Data			
*If ConcreteReinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
*If ConcreteReinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
*If ConcreteTotal Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
*If ConcreteStrength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m²

Figure 34 - Section of Structural Data Set for the Slab in Construction phase, II tier: Level of Information Need – Structural

Mechanical Data			
Air Flow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
Temperature Range	Allowable minimum and maximum temperature.	numeric	°C
Air Pressure	The pressure within a container due to the compression of atmospheric gases.	numeric	Pa

Figure 35 - Section of Mechanical Data Set for the Duct in Construction phase, II tier: Level of Information Need – MEP

4.5. III tier: BIM Uses

Third tier focuses on providing rules and guidelines regarding the specific BIM Uses. It inherits the rules provided in the earlier tiers and further defines directives needed to perform accurately, in this case, Cost Estimation and Energy Analysis. Each use contains set of modelling rules that should be followed, as well as Level of Information Need that should be assigned to the elements. It is important to note that Requirements Specificator provides overall approach, and that information content can vary depending on the milestone, purpose and software being used.

4.5.1. Cost Estimation

When it comes to Cost Estimation, the rules and Level of Information Need vary significantly on the purpose of the quantity take-off e.g., QTO for tendering or QTO for fabrication. Chosen approach for the Requirements Specificator follows the BIMMS company workflow, hence it addresses frequent modelling issues that lead to inaccurate quantities and information content that is needed to perform the estimation using Bexel software. This tier is a result of research conducted on the company's standard QTO practice as well as content addressed by the company's professionals.

Majority of viable rules for QTO are already addressed by the previous alphanumerical and geometrical requirements, meaning the tier itself inherits previous and contains a few more rules that are significant for performing the use (Figure 36).

COST ESTIMATION

1	**Structural Types**

Elements that are from the construction perspective considered different structural types shall be modelled as individual types.

* e.g., wooden walls of different heights, that are constructed differently

2	**Resource Naming**

All resources shall follow the same naming convention.

* This allows grouping the quantities of each resource.

3	**Ceiling drops and coves**

Ceiling drops and coves shall be modelled as walls containing the same layers as ceiling.

*Up to 300mm they are quantified in metres.

4	**Compound elements**

Every layer of compound element shall be modelled as to present the accurate dimensions of the accurate construction.

5	**Reinforced structures and formwork in concrete elements**

If not modelled, reinforced structures and formwork quantities shall be obtained from modelled geometry using ratios provided by structural designer.

*Amount of reinforcement weight per unit of volume for each element category (proposed by Mauricio Morales, BIMMS)

Element Category	Reinforcement weight per unit of volume (kg/m^3)
Beams	300
Columns	325
Ground Concrete Slab	65
Concrete Slab	110
Concrete Walls	120
Foundation Isolated Slab	85
Foundation Beam	280
Foundation Floating Slab	20

6	**Commercial size**

Specifying the size according to provided list of commercial sizes: piping,cable trays and ducting.

Figure 36 - Cost Estimation ruleset, III tier: Cost Estimation

Concerning the Level of Information Need for the elements, the scope is to avoid insufficiency and excess of data within the model. Having this in mind information content is a subset of data provided in the overall section of Level of Information Need. It addresses content of all discipline elements, relevant for performing QTO. It is grouped under following sets:

1. **Identity Data** – providing naming and identification data of the element;
2. **Material Data** – providing data regarding the material;
3. **Dimensional Data** – providing dimensional data needed for QTO;
4. **Cost Data** – providing data about cost of the material, equipment and labour; and
5. **Phasing** – assigning the project phase.

Data given in the overall section is expanded to fit the QTO use. Special attention is put to the content of Dimensional Data since it is one of the key aspects of proper extraction of quantities. Where needed, general dimensional data is expanded with data required for extraction of specific position e.g., Exposed height parameter (height of the element from the finish floor level of the bottom storey to the finish ceiling level) is added to the wall element, since it is used for calculating quantities of the wall finish. With structural elements category of Structural Data is filled with information addressing reinforcement quantities as well as formwork area needed for calculation and planning of formwork placement and removal (Figure 37).

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation:**			
Actor:				
Object:	"Column" / IfcColumn			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Penetrations and connections are modelled to nominal dimensions.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Not required			
Parametric behaviour:	Not required			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Construction stage indicating when the element was created e.g., New Construction.	text	/
	Type	Construction stage indicating when the element was demolished.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	Identification.	text	/
		Material		
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel Finish	The type of finish for the steel column.	text	/
		Dimensional Data		
	Length	Total length of the column.	numeric	m
	Section Dimensions/Diametar	Width and depth / diametar of the column section.	numeric	m
	*If Steel Weight	The weight of the steel per unit length.	numeric	kg/l
	*If Concrete/Precast Gross Volume	Volume of the column, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Precast Net Volume	Volume of the column, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete Outer Surface Area	Total area of the extruded surfaces of the column (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m^2
		Structural Data		
	*If ConcreteReinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If ConcreteReinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If ConcreteTotal Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Bill-of-materials, bill-of-quantities			

Figure 37 - Level of Information Need of the Column for conducting QTO, III tier: Cost Estimation

Created QTO library, addresses Level of Information Need of most frequently used elements from all three disciplines (Table 8).

Table 8 - Elements and Number of associated parameters, III tier: Cost Estimation

Elements	Data Sets						
	Identity Data	Material Data	Dimensional Data	Cost Data	Performance Data	Structural Data	Phasing
Wall / IfcWall	6	5	6	3	1		1
Curtain Wall / IfcCurtainWall	6	5	5	3			1
Flooring / IfcCovering	6	7	3	3			1
Ceiling / IfcCovering	6	7	3	3			1
Door / IfcDoor	6	5	5	3			1
Window / IfcWindow	6	6	8	3			1
Roof / IfcRoof	6	6	5	3			1
Stairs / IfcStairs	6	6	7	3			1
Structural Wall / IfcWall	6	1	6	3		5	1
Column / IfcColumn (Figure 34)	6	2	6	3		5	1
Beam / IfcBeam	6	2	9	3		6	1
Slab / IfcSlab	6	2	5	3		6	1
Foundation / IfcFooting / IfcPile	6	1	11	3		6	1
Duct / IfcDuctSegment	6	2	4	3			1
Duct Fitting / IfcDuct Fitting	10	2	4	3	3		1
AirTerminal / IfcAirTerminal	10	2	3	3			1
Coil / IfcCoil	10	1	3	3			1
Chiller / IfcChiller	10	1	3	3			1
Boiler / IfcBoiler	10	1	4	3			1
AirConditioning / IfcUnitaryEquipment	10	1	3	3			1
Piping / IfcPipeSegment	10	1	3	3	3		1
Valve / IfcValve	10	2	1	3			1
Bathtub / IfcSanitaryTerminal	10	2	3	3			1
Bidet / IfcSanitaryTerminal	10	1	3	3			1
Sink / IfcSanitaryTerminal	10	1	3	3			1
Urinal / IfcSanitaryTerminal	10	1	3	3			1
Lavatory / IfcSanitaryTerminal	10	1	3	3			1
Shower / IfcSanitaryTerminal	10	3	3	3			1
WaterCloset / IfcSanitaryTerminal	10	3	3	3			1
FloorDrain / IfcSanitaryTerminal	10	1	1	3			1
Tank / IfcTank	10	1	3	3			1
CableTray / IfcCableCarrierSegment	6	1	3	3			1
Conduit / IfcCableCarrierSegment	6	1	2	3			1
Switch / IfcSwitchingDevice	6	1	3	3			1
Transformer / IfcTransformer	8	1	3	3			1
Outlet / IfcOutlet	6	1	2	3			1
Distribution Board / IfcElectricDistributionBorad	6	1	2	3			1
Light Fixture / IfcLightFixture	6	1	2	3			1
Lamp / IfcLamp	6	1	2	3			1
	304	**90**	**151**	**117**	**7**	**28**	**39**
							736

4.5.2. Energy Analysis

This tier covers modelling guidelines and necessary content for executing Energy Analysis. Due to the software-driven nature of this analysis, Requirements Specificator aims to establish general rules for proper alignment during the analysis process. The basis for this tier comes from thorough research into the Energy Analysis subject. It is based on the studying available guides, manuals and testing out various software platforms. Given the variations and possible conflicts between the requirements of different providers, this approach concentrates on the universally accepted methods. The aim is to provide base of requirements needed for proper execution of Energy Analysis, while overcoming the complexities associated with diverse software environments.

The initial segment of this section revolves around modelling rules and guidelines. In the topic of Energy analysis, few aspects are vital: Location and Position; Building envelope and Room and Space Boundaries.

In other words, it is important to accurately specify location, weather station and to address surrounding objects if existing. Then to ensure that the modelling process is aligned to proper translation of building envelope to analysis software, and thirdly to address rooms and spaces modelling rules that are vital for creation of thermal zones. Addressing these topics, rules were specified. For illustration purposes, section of rules is provided below, whereas the whole schema is provided in the Appendix 7:

1. **Location** – *Model shall have specified Location/Project Address.*

2. **Weather Station** – *Model shall have weather station defined.*

3. **Surrounding building** – *All external shadowing buildings shall be modelled as mass blocks. They shall not contain mass floors.*

4. **Materials** – *Every element shall have defined material layers.*

5. **Compound Elements** – *Building elements should be modelled as single integral element that contains layers. *It is not advisable to model each layer separately.*

6. **Sandwiched Elements** – *In the case of two Wall layers being placed next to each other, only one shall be RoomBounding.*

7. **Wall Centerline** – *In case of aligning walls that have different thickness, centerline shall be aligned, not the exterior edge.*

8. **External Elements** – *All External Elements shall be marked as Is External.*

9. **Walls of different materials** – *Walls that are continuous, but made of different materials, shall be modelled separately. *Material Thermal Data is different.*

10. **Shading Devices** – *Shading devices should be created using walls, roof or mullion families.*

11. **Redundant Space** – *All interior areas shall have room placed e.g., shaft and unoccupied space as well. *Rooms are used for differing interior and exterior space. If there is no Room adjacent to another space, then the vertical wall is considered as an Exterior wall.*

12. **Rooms inside Rooms** – *Placing rooms inside other Rooms shall be avoided.*

13. **Room Separation Line** – *Room Separation Line shall be used only if there is no other element e.g., wall separating two spaces. Room Separation Line shall not be placed next to the wall. *This can result in bounding issues.*

14. **Space –** *Spaces shall be modelled from finished floor to finished ceiling. In case the space contains suspended ceiling, spaces shall be made both for the room space and the plenum area.*

Rules that require clearer understanding of the specification are accompanied by explanatory details as shown below (Figure 38).

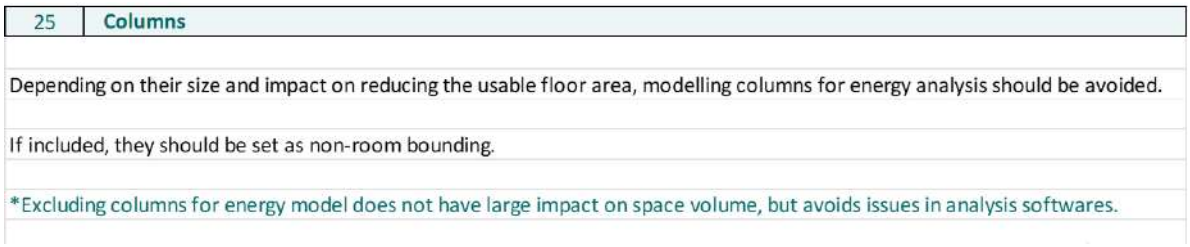

Figure 38 - Requirement for modelling column, III tier: Energy Analysis

The second section of this tier addresses Level of Information Need for the elements included in the Energy Analysis. It includes two sections: repository of architectural elements needed for the energy analysis of the building and a library of MEP elements that are relevant for the HVAC energy performance analysis.

In the topic of the energy assessment of buildings, specific details about architectural elements need to be addressed. This involves their dimensions, material, thermal and analytical data related to that material. To manage this, properties were organized into following sets:

1. **Identity Data** – providing naming and identification data of the element;
2. **Material Data** – providing data regarding the material;
3. **Material Thermal Data** – providing data regarding the thermal characteristics of the material (Figure 39);
4. **Analytical Data** – providing data regarding the heat transfer, thermal resistance and mass;
5. **Performance Data** – providing data about the elements performance;
6. **Dimensional Data** – providing dimensional data about the element;
7. **Performance Data** – providing data about the elements performance;
8. **Phasing** – assigning the project phase.

Within doors and windows elements sets addressing glazing and shading information were added.

9. ***If shading / *If Glazing** – providing data about glazing/shading elements.

Material Thermal Data			
*Depending on the type of material, Thermal Data information can very.			
Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
*If on the ground Soil Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg*C
Density	Substance's mass per unit of volume.	numeric	kg/l
Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
Analytical Data			
Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	W/(m²*K)
Thermal Resistance®	The temperature difference by which an object or material resists a heat flow.	numeric	(m²*K)/W
Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	kg ft²/(s²K)

Figure 39 - Material Thermal Data and Analytical Data of the Flooring, III tier: Energy Analysis

When it comes to specifying data content for the analysis of HVAC systems, functionalities of Energy Plus software were researched. It was decided to use this tool as a reference since it is considered one of the most detailed software's for this type of analysis. Information was grouped as following:

1. **Identity Data** – providing data regarding the thermal characteristics of the material;

2. **Analytical Data** – providing data regarding the capacities and rates of the element(Figure 40);

3. **Phasing** – assigning the project phase.

Analytical Data			
Cooling Capacity	The design capacity of the cooling coil.	numeric	W
Heating Capacity	The design capacity of the heating coil.	numeric	W
Inlet/Outlet Node Names	The names of the nodes where the fluid medium enters and exits the heating coil.	text	/
Heat Exchanger Configuration	The coil is operable in two configurations: CounterFlow or CrossFlow.	text	/
*If Steam Maximum Steam Flow Rate	The maximum possible steam volumetric flow rate in m3/s through the steam heating coil.	numeric	m3/sec
*If Water Maximum Water Flow Rate	The maximum possible water volume flow rate (m3/sec) through the coil.	numeric	m3/sec
Maximum Air Flow Rate	The maximum possible air volume flow rate (m3/sec) through the coil.	numeric	m3/sec
Inlet Water Temperature	The inlet water temperature for the design flow.	numeric	°C
Outlet Water Temperature	The outlet water temperature corresponding to the rated heating capacity.	numeric	°C
Inlet Air Temperature	The inlet air temperature for the design flow.	numeric	°C
Outlet Air Temperature	The outlet air condition desired for design flow.	numeric	°C
Inlet Air Humidity Ratio	The highest value of humidity ratio possible for the Design inlet air stream.	numeric	kgWater/kgDryAir
Outlet Air Humidity Ratio	The value of humidity ratio for the Design outlet air stream.	numeric	kgWater/kgDryAir
Availability Schedule	Schedule that defines when the coil is available. The name of the schedule (ref: Schedule) that denotes whether the coil can run during a given time period. A schedule value greater than 0 (usually 1 is used) indicates that the unit can be on during a given time period. A value less than or equal to 0 (usually 0 is used) denotes that the unit is off. If this field is blank, the schedule has a value of 1 for all time periods.	numeric	/

Figure 40 - Analytical Data of the Coil, III tier: Energy Analysis

The created library addresses Level of Information Need of the following elements (Table 9).

Table 9 - Elements and Number of associated parameters, III tier: Energy Analysis

Elements	Data Sets									
	Identity Data	Material Data	Dimensional Data	Thermal Data	Analytical Data	Performance Data	Electrical Data	Glazing Data	Shading Data	Phasing
Space / IfcSpace	6	3	3	6	19					1
Zone / IfcZone	5	3	3	3	15	1				1
Wall / IfcWall	4	5	3	4	3	2				1
Flooring / IfcCovering	4	5	3	5	3	2				1
Ceiling / IfcCovering	4	7	3	4	3					1
Door / IfcDoor	2	5	3	4	3	1		7		1
Window / IfcWindow	3	7	6	4	8	6			6	1
Roof / IfcRoof	3	6	4	4	3	2				1
Duct / IfcDuctSegment	9	2	5		2					1
AirTerminal / IfcAirTerminal	12	2	5		10	1				1
Coil / IfcCoil	6	1			14					1
Fan / IfcFan	7				10					1
Chiller / IfcChiller	6	1	3		15		2			1
Boiler / IfcBoiler	6	1			13					1
AirConditioning / IfcUnitaryEquipment	10	1			4		2			1
Piping / IfcPipeSegment	10	1	2		4					1
Transformer / IfcTransformer	5		3		10		2			1
	102	**50**	**46**	**34**	**139**	**15**	**6**	**7**	**6**	**17**
										422

4.6. Quantitative Overview of Created Requirements

The created Specificator includes 75 requirements with accompanying guidelines and 182 specifications for the Level of Information Need, all classified according to purpose and project milestones (Figure 41). It encompasses more than 15 different property sets and an extensive range of parameter occurences: 3535 parameters for three different project phases, 736 parameters for Cost Estimation and 422 parameters for Energy Analysis. This provides an extensive base to be used in defining requirements and results in 4693 rules that can be imployed during the verification of the model.

Figure 41 – Visual representation of requirements and parameters quantification

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5. VERIFICATION / CASE STUDY

The proposed methodology was subjected to validation through a case study. In collaboration with BIMMS, the Requirements Specificator was implemented in the project that is currently being developed within the company. The implementation process included realization of the model within Autodesk Revit platform, followed by the exporting to the IFC format.

5.1. Verification rules and requirements

In order to investigate possible verification approaches, a subset of the rules was extracted from the Requirements Specificator:

Unique Room Naming – There shall be no rooms containing the same room number.

Unallocated / Unplaced Rooms – Model shall not contain rooms that are not placed.

Room Area – Room Area shall be the same as area required and defined by the Room Schedule.

Elements intersection – Model shall not contain elements that overlap/intersect.

Minimal handrail height – Minimal handrail height for stairs and ramps shall not be less than 900mm.

Elements Location – Doors/Windows – Windows and doors shall be assigned to the same floor as the walls or roof in which they are located.

Level of Information Need – Elements shall contain the information content defined by the Level of Information Need.

5.2. Verification Methodology

In agreement with the company, it was decided to investigate two possible approaches of checking the rules defined in the subset: Checking if the Revit file complies to the modelling rules and Checking the compliance of the IFC file to the proposed rules and information requirements.

First approach is intended for the use during modelling process, by the team members creating the model. It represents quality assurance measurement that is being performed while the model is being developed, enabling users to identify and rectify mistakes before exporting to the IFC format. Consequently, leading to reduction in both time and effort when compared to the conventional process of exporting the model and conducting validation using external software tools like Solibri or Navisworks.

Second approach is designed to accommodate both the internal verifications of the quality and the external assessment undertaken by the client. It aims to address the compliance of the IFC file that is being delivered to the client, to the information requirements defined by the EIR.

Based on this, three methodologies of verifications were conducted. Using Visual Programming Language within Dynamo platform to test the Revit model, using Python programming language with the IfcOpenShell and IDS for the checking of the IFC file (Figure 42).

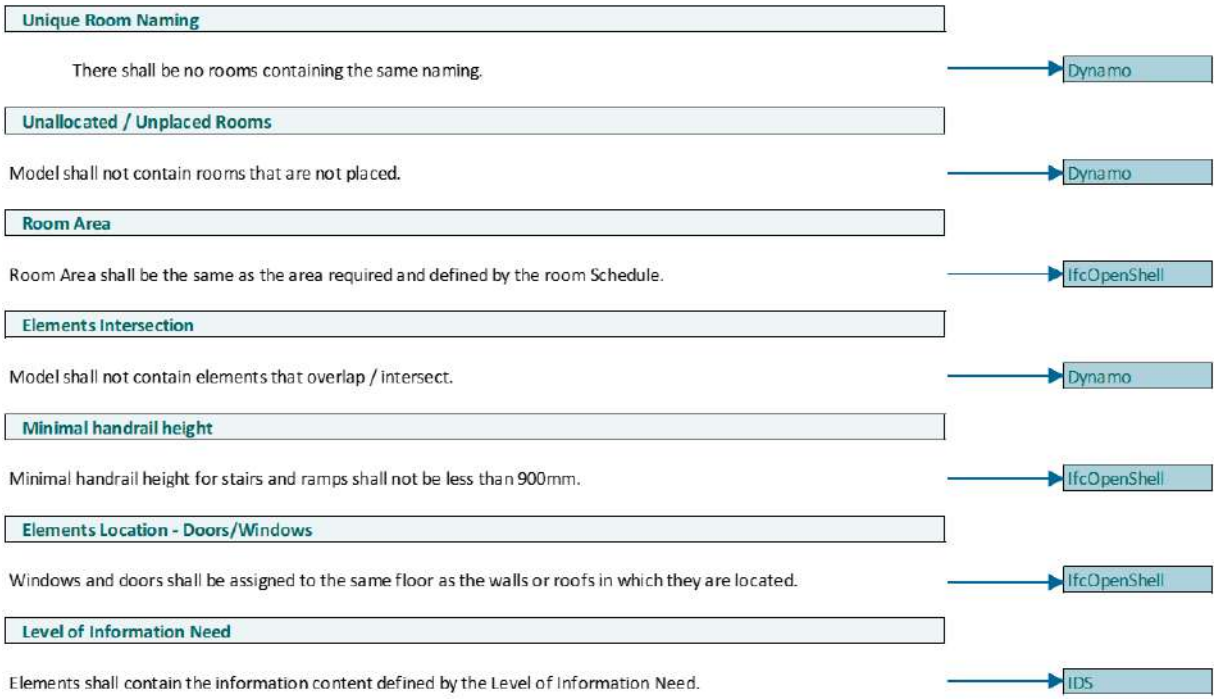

Figure 42 – Assigning Verification methods to chosen rules

5.3. Dynamo

As explained previously, first verification methodology uses Visual Programming language within Dynamo environment. The aim is to perform three different checks on the Revit model developed by company. First two verifications address and validate the architectural model, whereas third checking employs both architectural model and MEP model that is linked.

5.3.1. Unique Room Naming

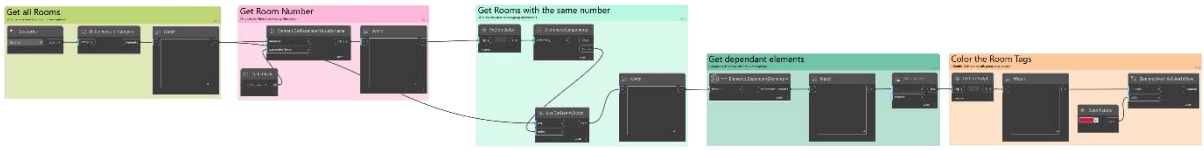

Figure 43 - Dynamo script for checking unique room naming

This verification includes a script designed for verifying unique room naming (Figure 43). It assures that the model does not contain duplicated room names. It is based on the condition, if the rooms contain the same room number, they are duplicated and shall be marked as such. Process includes several steps as shown below (Figure 44).

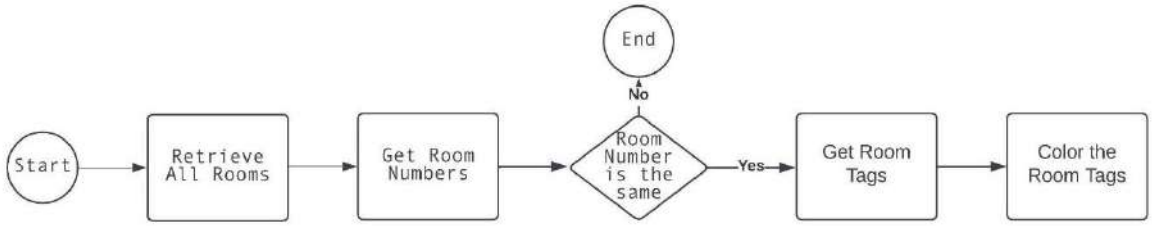

Figure 44 - Checking unique room naming – process flow

First, all the elements of the room category are collected along with the values of the property Number. In order to parse the ones containing the same number value two possible approaches are identified, first, using sequence of nodes to identify and extract duplicated numbers and second, using a Python script (Figure 45). Since the node approach would mean that data is growing exponentially with checking of each number, duplicating the information for each occurrence, a Python script is chosen as a more efficient approach.

Python Script

```python
def find_duplicate_indices(room_numbers):
    # Create a dictionary to store the indices of each room number
    indices_dict = {}
    duplicates_indices = {}

    # Iterate through the room numbers list
    for index, room_number in enumerate(room_numbers):
        # If the room number is not in the dictionary, add it
        if room_number not in indices_dict:
            indices_dict[room_number] = index
        else:
            # If the room number is already in the dictionary, it's a duplicate
            if room_number not in duplicates_indices:
                duplicates_indices[room_number] = [indices_dict[room_number]]
            duplicates_indices[room_number].append(index)

    return duplicates_indices

# Input list containing all room numbers
room_numbers = IN[0]

# Find the indices of duplicated elements
duplicated_indices = find_duplicate_indices(room_numbers)

OUT = duplicated_indices
```

Figure 45 - Searching for duplicated indices – Python script

Script takes a list of room numbers as input and defines a function for finding duplicated indices. Within the function two dictionaries are initialized, one to keep track of the first occurrence of each room number and another to identify duplicate occurrences. In other words, it checks if the room number has been seen before, without storing unnecessary duplicate information. Output of the script provides a dictionary that associates key (room number) with values (indices).

After retrieving the rooms that are duplicated, second step is to present them within the model graphically. Simply overriding the room elements with different colour can be one approach, but it presents an issue if the view template and visibility overrides do not include colour fill. Taking this into consideration, instead of colouring the rooms itself, the room tags connected to them should be coloured. In order to get the room tags of the duplicated rooms first, a list of all dependant elements is identified. Then a python script was used to extract only room tags from the list (Figure 46).

```python
import clr
clr.AddReference('RevitAPI')
from Autodesk.Revit.DB import *
clr.AddReference('RevitServices')
from RevitServices.Persistence import DocumentManager

# Access the current Revit document
doc = DocumentManager.Instance.CurrentDBDocument

# Function to filter RoomTag elements from a list of elements
def filter_room_tags_from_elements(elements):
    room_tags = []
    for element in elements:
        if element.GetType().Name == "RoomTag":
            room_tags.append(element)
    return room_tags

# Input: elements_list (List of Revit elements)
elements_list = UnwrapElement(IN[0])

# Call the function to filter RoomTags from the input list
room_tags_list = filter_room_tags_from_elements(elements_list)

# Output the list of RoomTags
OUT = room_tags_list
```

Figure 46 - Searching for related room tags – Python script

The provided verification of the Revit file showed that there are three rooms containing the same room number, displayed as in the Figure 47.

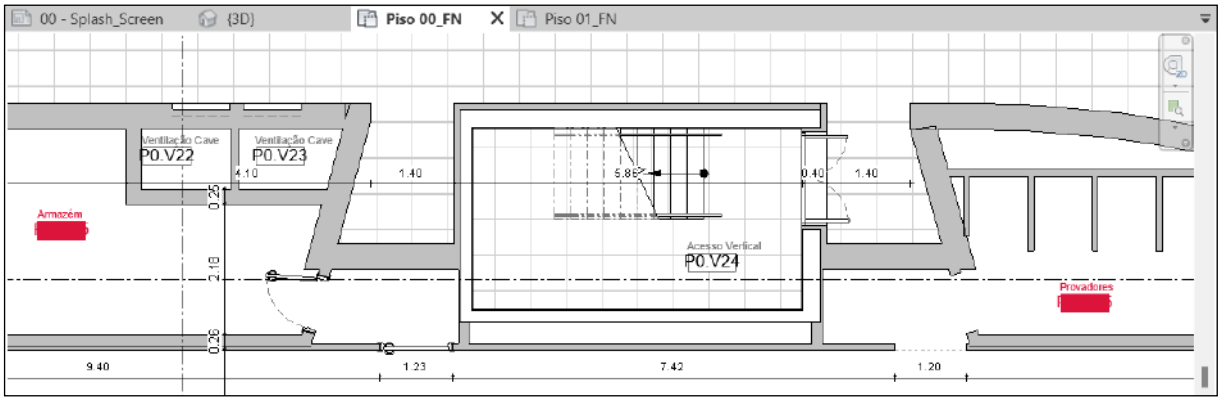

Figure 47 – Visualization of results of duplicated numbers check within Revit

5.3.2. Unallocated / Unplaced Rooms

This verification checks if the Revit file contains unplaced rooms and exports a report with elements data to Excel sheet (Figure 48). Process defined in the script, retrieves all the elements of category room contained in the model and checks their location (Figures 49).

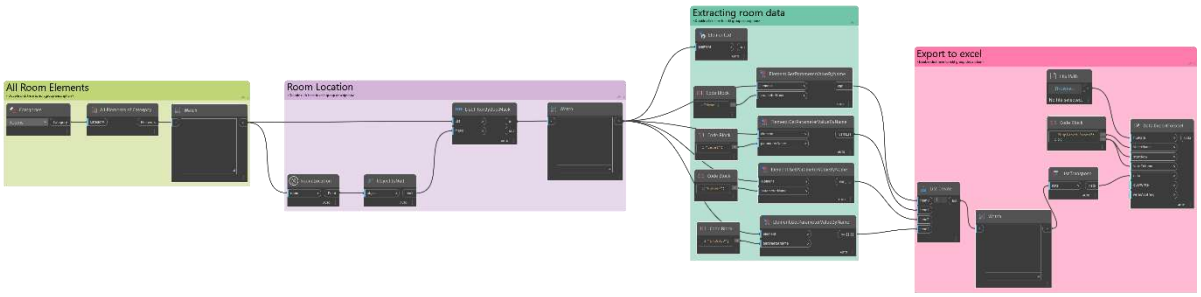

Figure 48 - Dynamo script for checking unplaced rooms

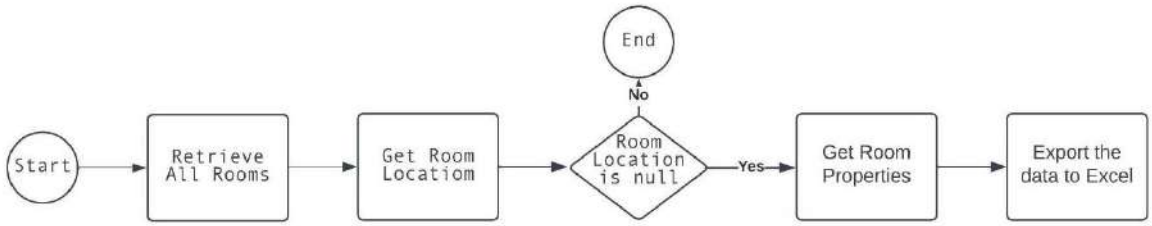

Figure 49 - Checking for unplaced rooms – process flow

The list of all room elements is created followed by the extraction of rooms location values. Created list is then filtered with null values, so it outputs the list of rooms that are unplaced. In other words, functionalities of Object.IsNull node are used to filter the elements which location value equals zero. Then the parameter values associated with those room elements are collected. Script extracts information relevant to rooms identification: Name, Number, Level and GUID. After creating the list of parameter values associated to each room, it exports the data to Excel sheet creating a report.

Performed verification showed that four rooms contained within Revit file are unplaced. The results were then confirmed with creation of the room schedule which listed the same instances (Figure 50).

Ref.	Designação	Piso	Perímetro	Área	INFO Sito	INFO Edificio	INFO Piani	INFO Vano
P0.V15	Armazém	Not Placed	Not Placed	Not Placed	PCZ	E1	P0	V016
P0.V20	IS S	Not Placed	Not Placed	Not Placed	PCZ	E1	P0	V028
P1.V33	Sala de Reuniões	Not Placed	Not Placed	Not Placed	PCZ	E1	P1	V072
P2.V19	Gabinete	Not Placed	Not Placed	Not Placed	PCZ	E1	P2	V084
P2.V27	Gabinete	Not Placed	Not Placed	Not Placed	PCZ	E1	P2	V099
5				0.00 m²				

P0.V20	IS S	Piso 00	2_H5pBNZ1C6eaZQt2mS2sN
P0.V15	Armazém	Piso 00	2_H5pBNZ1C6eaZQt2mS2oY
P1.V33	Sala de Reuniões	Piso 01	2_H5pBNZ1C6eaZQt2mS3Kw
P2.V19	Gabinete	Piso 02	2_H5pBNZ1C6eaZQt2mS31V
P2.V27	Gabinete	Piso 02	2_H5pBNZ1C6eaZQt2mS3_w

Figure 50 - Results of the unplaced rooms check

5.3.3. Intersection of Elements

Third verification is the most complex since it addresses not one but two models. It checks the intersection of the elements within the Architectural model with the elements contained in the linked MEP model (Figure 51). The script verifies if there is intersection between the wall and the pipe instances (Figure 52).

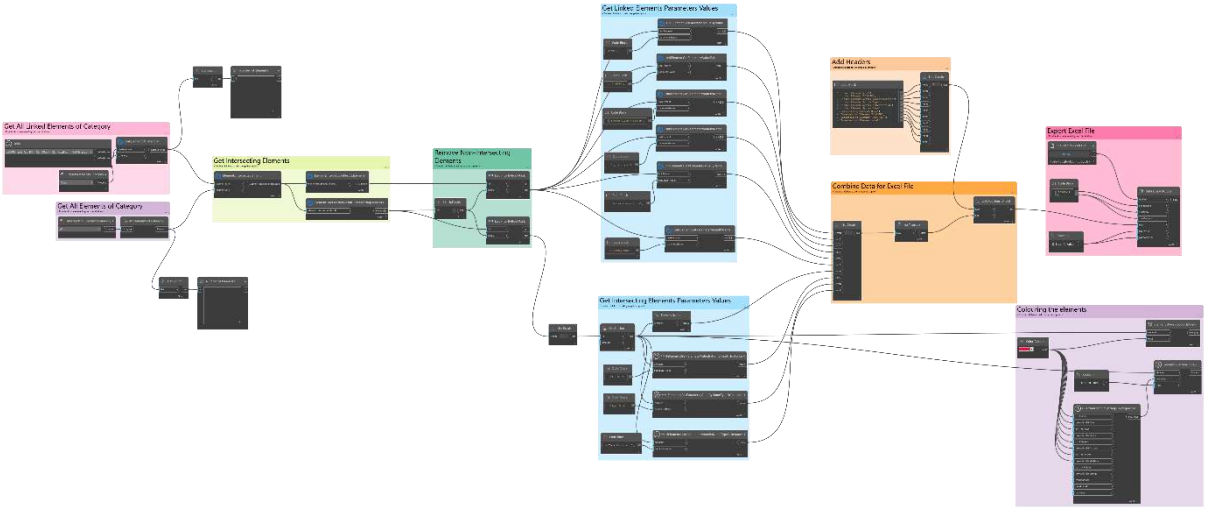

Figure 51 - Dynamo script for checking intersecting elements

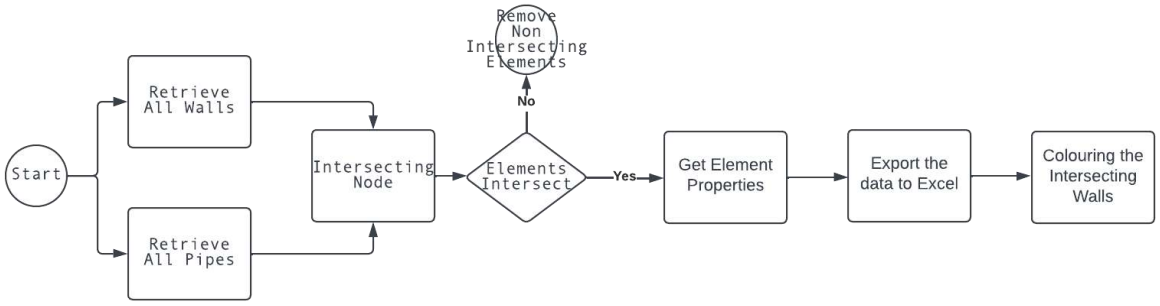

Figure 52 - Checking for element intersection – process flow

The first step of the process is retrieving all elements of these two categories within the models. In this specific case, piping is not directly represented within working model, but contained in the linked model, so it uses different retrieving approach comparing to the walls. Instead of using standard nodes integrated in Dynamo, it requires using the functionalities within the nodes specifically intended to deal with linked elements, provided by BimorphNodes package. This package allows interaction with linked elements and functions for addressing their intersection. Element.IntersectsElements functionality is employed to detect intersections, which is then followed by result nodes displaying elements of both categories. The way BimorphNodes operates, results in displaying two distinct lists. One of the lists contains all piping instances that were evaluated, while the other displays all wall instances, where empty values are provided for the walls that do not intersect. In order to extract only the elements that have intersection, next step involves filtering process. By utilizing List.IsEmpty node on the walls result, a list of indices is created which is then used as a mask for filtering both lists (Figure 53).

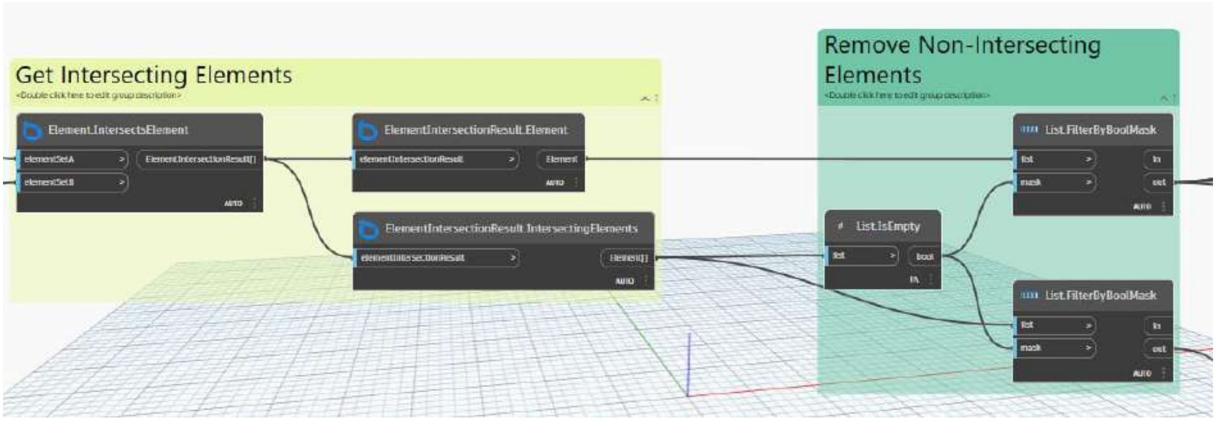

Figure 53 - Filtering the intersected elements

After getting the list of intersected elements, script retrieves the parameter values needed for the identification of the elements. For the piping elements it provides values regarding: Size, IfcGUID, System Classification, System Type, System Abbreviation and System Name. For the wall elements: Name, IfcGUID, Type Mark and Level. This data is then combined and exported into Excel sheet (Figure 54).

Linked Element Size	Linked Element IfcGUID	Linked Element System Classification	Linked Element System Type	Linked Element System Abbreviation	Linked Element System Name	Intersecting Element Name	Intersecting Element IfcGUID	Intersecting Element Type Mark	Intersecting Element Level
16ø	1Xs7DnCjrASeLL	Domestic Hot Water	LinkElement(Eler	DWH	AA.AQ 1	.wi.CER.PLA.PLS.BLC.E	1$xnqZn398Qx7g95ffw599	PI.217	Level(Name=Piso 02, Elevation
20ø	0ffbvTt5v0zxpGd	Domestic Hot Water	LinkElement(Eler	DWH	AA.AQ 1	.wi.CER.PLA.PLS.BLC.E	1$xnqZn398Qx7g95ffw599	PI.217	Level(Name=Piso 02, Elevation
16ø	2bi6y70tD7gOv8	Domestic Hot Water	LinkElement(Eler	DWH	AA.AQ 1	.wi.CER.PLA.PLS.BLC.E	3IpNFH7f15iwaQCeAuDL0A	PI.242	Level(Name=Piso 02, Elevation
160ø	3Twp1tu$95Hwi	Sanitary	LinkElement(Eler	RWD	AP 37	.wi.CER.PLA.PLS.BLC.E	1$xnqZn398Qx7g95ffw599	PI.217	Level(Name=Piso 02, Elevation
25ø	0HxYdja2n4hhz3	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.CER.PLA.PLS.BLC.E	3IpNFH7f15iwaQCeAuDL0A	PI.242	Level(Name=Piso 02, Elevation
90ø	3jUsf1nBP1IREcx	Sanitary	LinkElement(Eler	RWD	AP 7	.wi.BLC.EST 170mm	2HJqoNBk5APQG2OTaGOL(	PI.208	Level(Name=Piso 01, Elevation
16ø	2fxqODkEv2duKl	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	0gB9NRHxP61evBSYry8Url	PI.208	Level(Name=Piso 02, Elevation
16ø	2fxqODkEv2duKl	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	0gB9NRHxP61evBSYry8Url	PI.208	Level(Name=Piso 02, Elevation
16ø	2fxqODkEv2duKl	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	0gB9NRHxP61evBSYry8Url	PI.208	Level(Name=Piso 02, Elevation
16ø	2fxqODkEv2duKl	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	0gB9NRHxP61evBSYry8Url	PI.208	Level(Name=Piso 02, Elevation
16ø	0rP1EPJIj0_OZa9	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.CER.PLA.PLS.BLC.E	1$xnqZn398Qx7g95ffw2GH	PI.217	Level(Name=Piso 01, Elevation
16ø	0rP1EPJIj0_OZa9	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	2HJqoNBk5APQG2OTaGOK	PI.208	Level(Name=Piso 01, Elevation
16ø	0rP1EPJIj0_OZa9	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	2HJqoNBk5APQG2OTaGOK	PI.208	Level(Name=Piso 01, Elevation
16ø	2hC9DMkZXBrPr	Domestic Cold Water	LinkElement(Eler	DCW	AA.AF 4	.wi.BLC.EST 170mm	1$xnqZn398Qx7g95ffw591	PI.208	Level(Name=Piso 02, Elevation

Figure 54 - Report of performed check within Excel

For easier identification of the intersected elements within the model, graphic display of the results is also incorporated into the script. This step includes implementing colour-coding approach to highlight the walls that intersect with piping instances. In order for the colour to be displayed in all views, regardless of the view template, the overriding graphic settings functionality is revoked. As shown in the results below, this enables detection of the elements in different views (Figure 55).

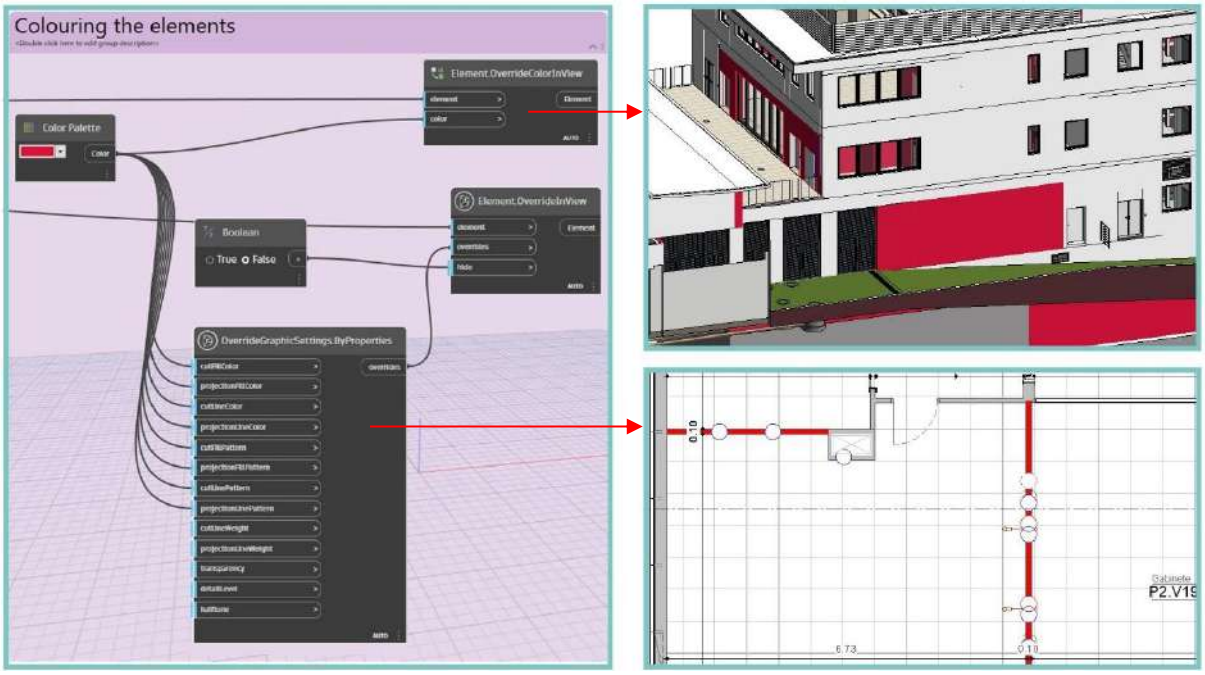

Figure 55 - Visual representation of results within Revit

5.4. IfcOpenShell

Second type of verification uses Python and IfcOpenShell to process IFC file and checks if it complies to certain requirement. For the purpose of research, three different aspects of verification are addressed through created scripts:

Alphanumerical – relying on the method of direct extraction of property and its value;

Geometrical – extracting geometric information of elements;

Checking of relations – navigating elements relationships.

5.4.1. Minimal handrail height

First verification procedure includes checking if the handrail height is less than 900 mm. This is relatively straightforward method as it checks the data contained directly within the IFC. As it can be seen in the property sets of the IfcRailing, Height property is stored in the Pset_RailingCommon meaning that is the container within which data should be processed.

Methodology of processing data, as described in Figure 56, is to retrieve all railing objects contained in the IFC file and then loop through each of them to find required property.

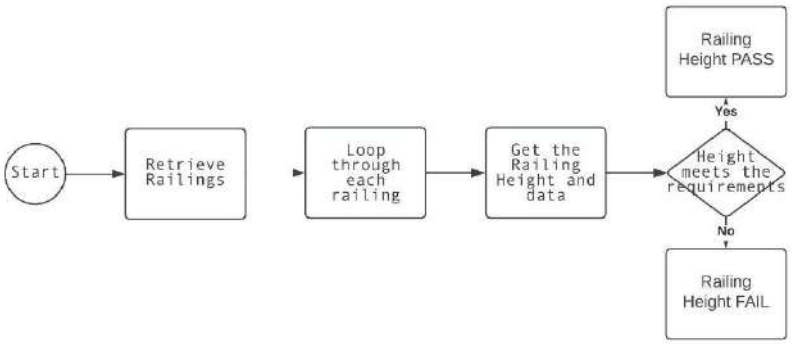

Figure 56 - Checking the railing height – process flow

Algorithm iterates through the property sets associated with the IFC object using IfcRel DefinesByProperties relationship. This relationship as defined by the IFC schema, enables the code to access property sets of the object and to identify the one called Pset_RailingCommon. Lastly, a function is called to retrieve the height property value and compare it to the required one. The railing that does not meet the requirements, is printed in results, along with the data that enable the element identification.

Performed verification of the IFC file showed that out of total number of 66 railing objects, 23 does not meet the height requirement (Figure 57). Upon further inspection of the displayed results, it is concluded that it is one type of the railing that has 23 instances in the file.

```
Railing Name: Railing:.arv.railing.metal.spl.wall 1000mm:4149939 | Railing GUID: 2oO$z0_lXCBges0V8dDWLP
| Height does not meet requirement (0.88m)
Total Railings: 66
Railings Not Meeting Requirement: 23
PS C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.RailingHeight>
```

Figure 57 - Results of performed check

5.4.2. Room Area

Second validation script checks if the areas of the rooms contained within the IFC file complies to the Room Schedule defined by the client. Unlike the first script which assess handrail height extracting property stored in the property set, this check employs geometrical calculations to generate the area of the rooms. It does not rely on the preexisting data that can be manipulated within the IFC schema, so it provides higher accuracy of calculations.

For execution of this verification first an Excel spreadsheet was formed based on the Room schedule requested by the client. The table created listed 143 rooms and data associated with them: Room Number, Room Name and Room Area (Figure 58).

Room Number	Long Name	Room Area
P0.V01	Acesso Vertical	15.65
P0.V02	Circulação	11.58
P0.V03	Área Técnica	3.57
P0.V04	Elevadores	4.46
P0.V05	Área Técnica	12.55
P0.V06	Área Técnica	2.49
P0.V07	Área Técnica	4.46
P0.V12	Área Comercial	623.96
P0.V13	Área de Exposição	5.77
P0.V14	Área de Exposição	5.81
P0.V15	Armazém	23.31

Room Number	Long Name	Room Area
P0.V01	Acesso Vertical	15.65
P0.V02	Circulação	11.58
P0.V03	Área Técnica	3.57
P0.V04	Elevadores	4.46
P0.V05	Área Técnica	12.55
P0.V06	Área Técnica	2.49
P0.V07	Área Técnica	4.46
P0.V08	Área Técnica	4.46
P0.V09	Área Técnica	4.46
P0.V10	Área Técnica	4.46
P0.V11	Área Técnica	4.46
P0.V12	Área Comercial	623.96
P0.V13	Área de Exposição	5.77
P0.V14	Área de Exposição	5.81
P0.V15	Armazém	23.31
P0.V16	Provadores	22.35
P0.V17	Vestíbulo IS	3.5
P0.V18	IS H	8.2
P0.V19	IS ADA	6.47
P0.V20	IS S	9.14
P0.V21	Courette	1
P0.V22	Ventilação Cave	1.53
P0.V23	Ventilação Cave	1.64
P0.V24	Acesso Vertical	16.65
P0.V25	Área Técnica - PT	20.52
P0.V26	Área Técnica - Gerador	9.21
P0.V27	Área Técnica - QE	8.27
P0.V28	Antecamara	3.96
P0.V33	Courette	4.46
P0.V34	Armazém	92.41
P0.V58	Acesso Vertical	18.31
P0.V59	Varanda	104.51
P0.V60	Área Técnica	11.06
P0.V61	Armazém	46.12
P0.V62	Área de Exposição	5.58
P1.V01	Acesso Vertical	17.69
P1.V03	Circulação	11
P1.V04	Área Técnica	4.58
P1.V05	Elevadores	12.98
P1.V07	Área Técnica	1.1
P1.V09	Lobby	89.1
P1.V10	Copa	28.56
P1.V11	Sala IT	14.05
P1.V14	Auditório	212.51
P1.V15	Camarins	8.13
P1.V16	Regie	6.77
P1.V17	Courette	0.69
P1.V18	Arrumos	4.74
P1.V21	Circulação	12.55
P1.V22	Courette	0.58
P1.V23	IS H + ADA	14.8
P1.V24	Acesso Vertical	16.65
P1.V25	Arrumos	24.29
P1.V26	Arrumos	13.78
P1.V27	Courette	0.68
P1.V28	IS S + ADA	19.62
P1.V29	Circulação	21.29
P1.V30	Gabinete	19.52
P1.V31	Gabinete	29.57
P1.V32	Sala de Reuniões	45.03
P1.V33	Sala de Reuniões	9.81
P1.V34	Sala de Reuniões	9.41
P1.V35	Espaço de Trabalho - Opens	53.63
P1.V36	Acesso Vertical	9.49
P1.V37	Varanda	61.72
P1.V38	Varanda	113.23
P1.V44	Gabinete	28.99
P1.V45	Arrumos	3.54
P1.V46	Circulação	2.89
P1.V47	Varanda	20.22
P2.V01	Acesso Vertical	16.1
P2.V02	Acesso Vertical	1.44
P2.V03	Circulação	11.04
P2.V04	Área Técnica	3.73
P2.V07	Área Técnica	1.04
P2.V08	Área Técnica	13.01
P2.V09	Lobby	99.82
P2.V10	Arrumos	10.85
P2.V11	IS H + ADA	14.8
P2.V12	Courette	0.58
P2.V13	Acesso Vertical	16.65
P2.V14	Circulação	25.68
P2.V15	Sala de Reuniões	20.99
P2.V16	Gabinete	71.26
P2.V17	Courette	0.71
P2.V18	Arrumos	4.99
P2.V22	Gabinete	38.82
P2.V23	Gabinete	19.87
P2.V24	Gabinete	18.74
P2.V25	Gabinete	29.59
P2.V26	Sala de Reuniões	25.63
P2.V27	Gabinete	39.48
P2.V28	Gabinete	27.4
P2.V29	Courette	0.66
P2.V30	IS S + ADA	19.62
P2.V31	Sala de Reuniões	9.15
P2.V32	Sala de Reuniões	8.78
P2.V33	Circulação	29.09
P2.V34	Sala de Reuniões	8.81
P2.V35	Sala de Reuniões	8.81
P2.V36	Sala de Reuniões	8.76
P2.V37	Sala de Reuniões	8.7
P2.V38	Espaço de Trabalho - Opens	59.83
P2.V39	Gabinete	21.99
P2.V40	Varanda	34.68
P2.V41	Courette	5.01
P3.V01	Acesso Vertical	16.65
P3.V02	Acesso Vertical	1.15
P3.V03	Circulação	8.9
P3.V05	Elevadores	12.47
P3.V07	Área Técnica	0.78
P3.V09	Circulação	10.95
P3.V10	IS	2.51
P3.V11	IS	3.32
P3.V12	Sala de Reuniões	86.94
P3.V13	Copa	7.42
P3.V14	Terraço	79.4
P3.V15	Área Técnica - Cobertura	179.89
P3.V16	Área Técnica - Cobertura	33.96
RF.V01	Cobertura	164.45
S1.V01	Acesso Vertical	16.64
S1.V02	Circulação	9.74
S1.V03	Área Técnica	4
S1.V09	Ventilação Cave	2.52
S2.V01	Acesso Vertical	11.68
S2.V03	Circulação	9.74
S2.V04	Área Técnica	4.04
S2.V06	Área Técnica	1028.51

Figure 58 - Room schedule spreadsheet in Excel

Second step in the verification process is creating the script that would check the provided IFC file. Overall methodology of processing data is described below (Figure 59).

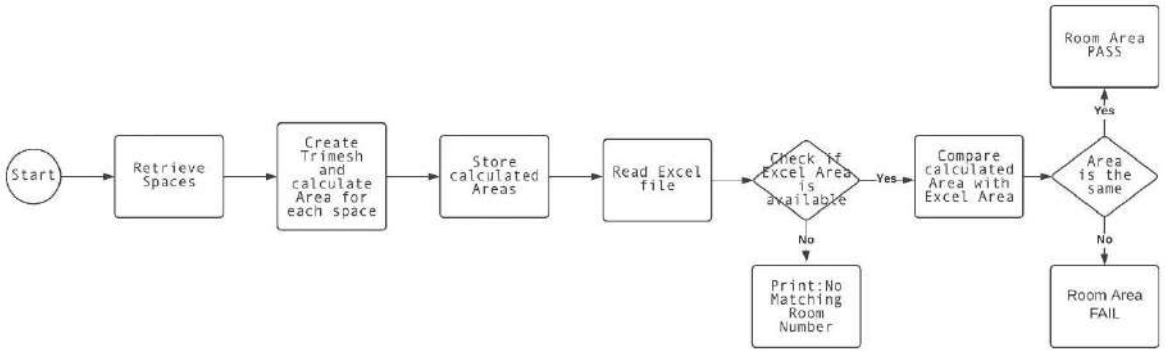

Figure 59 - Checking of room area – process flow

Algorithm collects all IfcSpace objects from the provided IFC and then processes geometry for each of them. It uses IfcOpenShell functionalities to extract faces and verts of the shape geometry, and then groups them into sets of three. Grouping function is necessary step as it forms triangles that are building the mesh that is generated using Trimesh functions. In order to get the area for each of the spaces, created meshes are cut with the horizontal planar surface through their centroid, giving section areas that represent the areas of the spaces. Section areas are rounded to two decimal places so they correspond to the ones provided by Excel sheet. Since the information requirements specify that Room Numbers is unique identifier of each of the rooms, it is used to connect the rooms extracted from the IFC file with the ones defined in the sheet. After collecting the data, the code is being used to compare the calculated areas with the ones given by the client, providing PASS/FAIL results.

After conducting the verification, results are printed, showing all spaces contained in the IFC file, their number, name, GUID, area and the PASS/FAIL result. Performed checking showed that 141/143 rooms

comply with the client's requirements. Provided information and GUID they allowed further identification of the ones that failed within the IFC viewer (Figure 60).

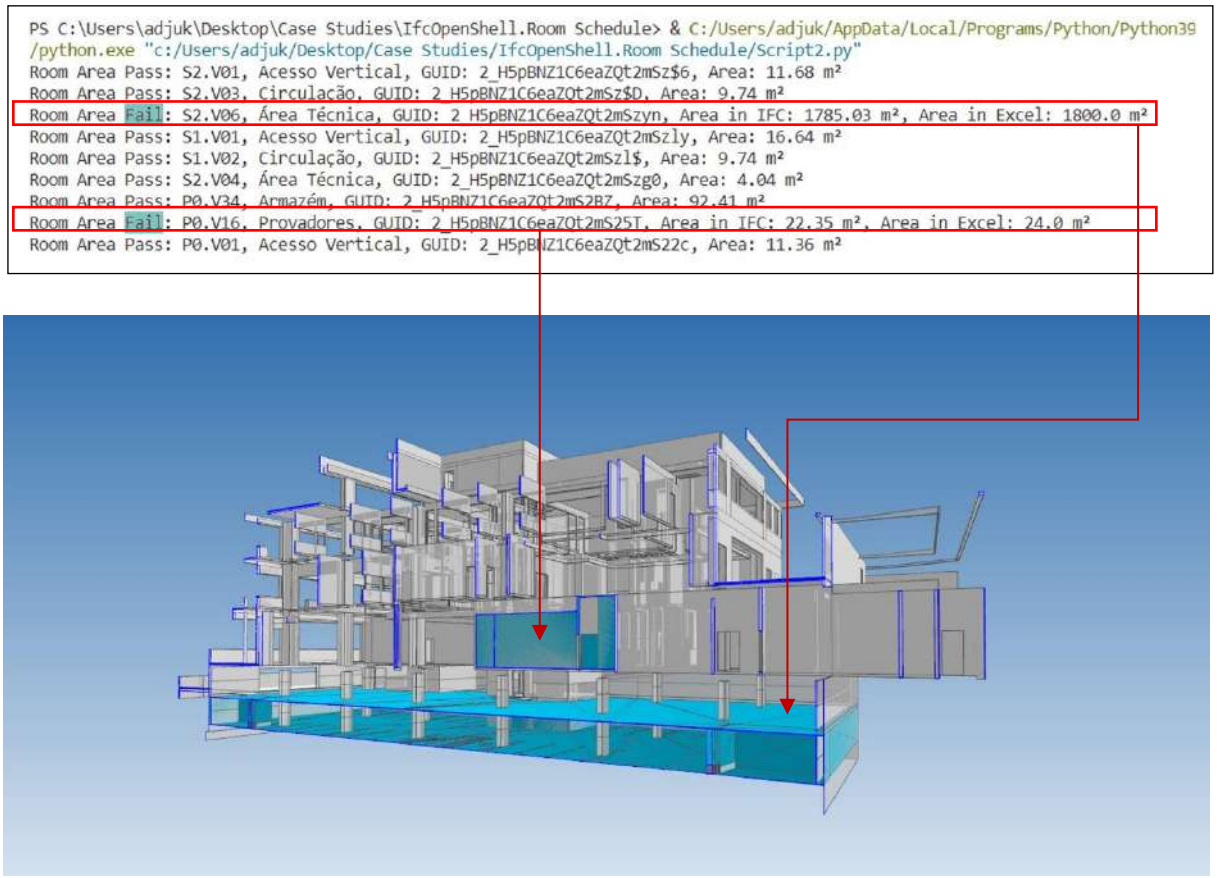

Figure 60 – Results of performed check

5.4.3. Elements Location – Doors/Windows

The third verification procedure checks if the doors and windows are located on the same level as the walls that are hosting them. Execution of this checking required writing a script that would run the IFC file and detect mismatches between the levels (Figure 61).

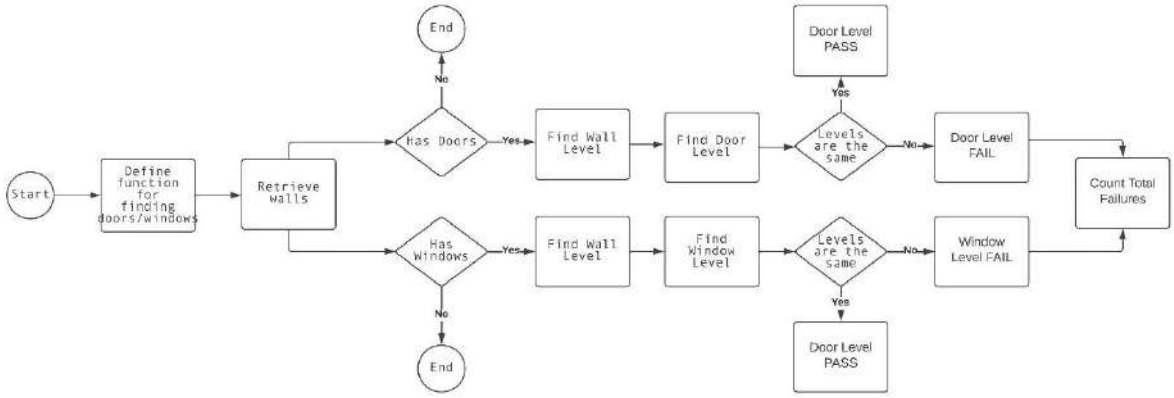

Figure 61 - Checking of elements location – process flow

In order to compare levels of the walls and hosted elements it is necessary first to define a function for finding doors and windows placed in the walls. Since there is no direct functionality to collect the hosted elements, process of finding doors and windows within the wall is based on the relations given in the IFC door and window containment schema provided below (Figure 62).

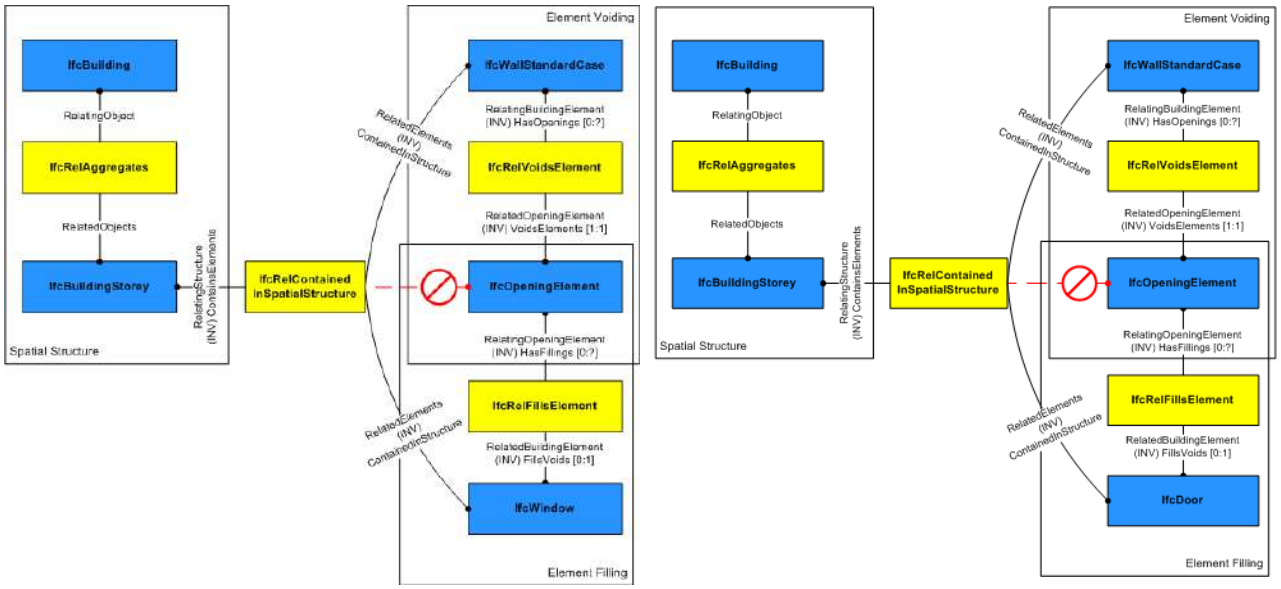

Figure 62 - IfcWindow and IfcDoor containment schema

Algorithm goes through IfcRelVoidsElements associated to the walls and iterates through these relationships to identify the opening elements connected to them. For each opening script evaluates if it is the IfcOpeningElement, ensuring that only valid openings are considered for further analysis. Once the openings are defined, it searches for the IfcRelFillsElement connected to them, linking the openings to the filling elements that are doors or windows (Figure 63).

```
    # Find IfcRelVoidsElement relationships
    void_relations = ifc_file.by_type("IfcRelVoidsElement")
    for rel in void_relations:
        if rel.RelatingBuildingElement == wall:
            opening = rel.RelatedOpeningElement
            if opening.is_a("IfcOpeningElement"):
                # Find IfcRelFillsElement relationships for the opening
                fill_relations = ifc_file.by_type("IfcRelFillsElement")
                for fill_rel in fill_relations:
                    if fill_rel.RelatingOpeningElement == opening:
                        filling = fill_rel.RelatedBuildingElement
                        if filling.is_a("IfcDoor"):
                            doors.append(filling)
                        elif filling.is_a("IfcWindow"):
                            windows.append(filling)
```

Figure 63 – Section of the script - searching for hosted elements

After returning the list of doors and windows connected to the wall, spatial containment of the elements is processed in order to find building storeys they are located on. Verification provides PASS/FAIL results, printing the relevant data of the walls and hosted elements if their levels mismatch.

Performed checking of the IFC file showed that out of 211 door and window elements 2 door elements are not on the same level as the walls they are placed in (Figure 64). Printed data revealed that walls are placed on the Piso 01, whereas doors level is Piso 00.

```
PS C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.Levels> & C:/Users/adjuk/AppData/Local/Programs/Python/Python39
/python.exe "c:/Users/adjuk/Desktop/Case Studies/IfcOpenShell.Levels/Script1.py"
Fail: Door level does not match wall level.
Wall Name: Basic Wall:.wi.EST.BLC.EST 190mm:1062253
Wall GUID: 2dqOqUXN1ElvYk5vidj84o
Wall Level: Piso 01
Door Name: Portaro 1F_PLANA:2000 x 800:4663095 | Door Level: Piso 00 | Door GUID: 1cw$vJ9VD68hrSJgzPid8y
---
Fail: Door level does not match wall level.
Wall Name: Basic Wall:.wi.EST.BLC.EST 190mm:1064790
Wall GUID: 1$xnqZn398Qx7g95ffw2K3
Wall Level: Piso 01
Door Name: Portaro 1F_PLANA:2000 x 800:4663096 | Door Level: Piso 00 | Door GUID: 1cw$vJ9VD68hrSJgzPid8p
---
Total Doors: 105
Total Windows: 106
Total Failures: 2
PS C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.Levels>
```

Figure 64 - Results of performed check

Results were then verified in the BIMCollab software to confirm the correctness of performed test. Smart view was created containing the GUID of the listed elements and then their data was assessed. Verification showed that they are on the same elevation, but with different containment relations to building storeys (Figure 65).

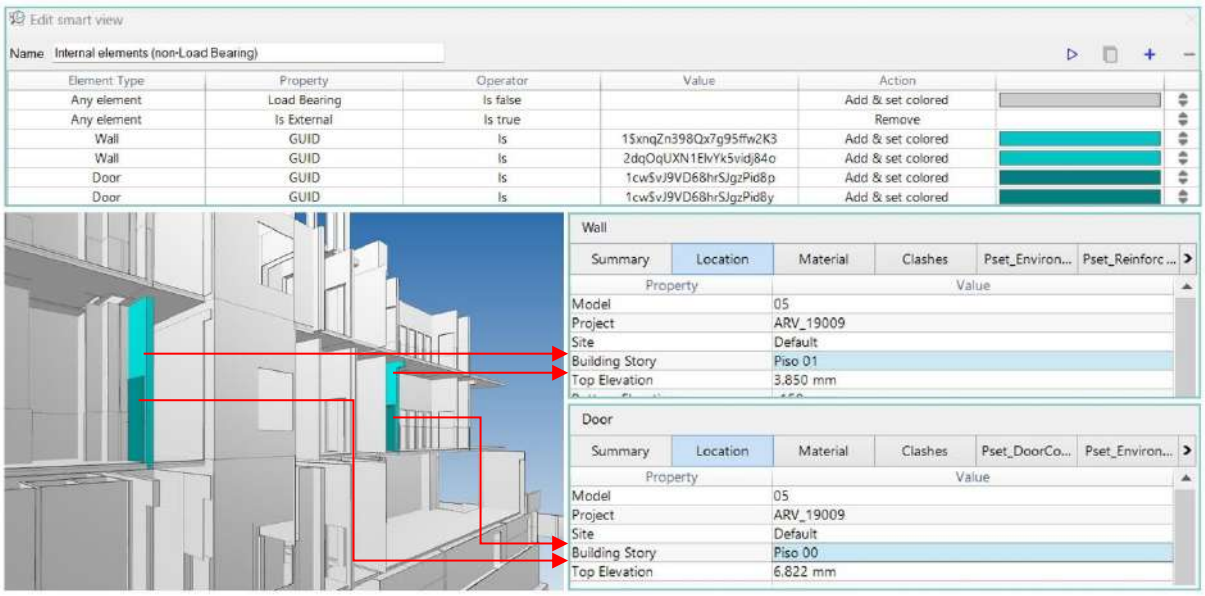

Figure 65 - Verification of results in IfcViewer

5.5. IDS

The third type of verification uses IDS format to check compliance of the IFC file to the Level of Information Need defined by the EIR. Two methods of using IDS were evaluated as the first one uses open approach, and the second uses tools developed by ACCA Software:

1. IDS Converter and IfcTester (BlenderBIM)

2. usBIM.IDS editor and usBIM.IDS validator.

For the purpose of this case study wall elements were chosen for the verification, so initially Revit file was populated with data and then exported to the IFC used for validation process.

5.6. Populating Revit file

The initial phase of verification process involved population of the wall elements within the Revit file with attributes defined by the Level of Information Need. Depending on the type of information, they were either created as type or instance parameters (Figure 66). Data connected to Cost, Installation and Warranty was set up as instance parameters since it can differ for each wall instance depending on the position and installation date. On the other hand, information concerning performance, description and manufacturer remains the same for the whole family type, so it was populated as type parameter. Properties that are identified as hard coded so already within the Revit file, were directly used, avoiding duplication of data entry. Additionally, populating the file with dimensional data was intentionally omitted from this step, as it is generated automatically during the IFC export process. This approach prevented unnecessary redundancy.

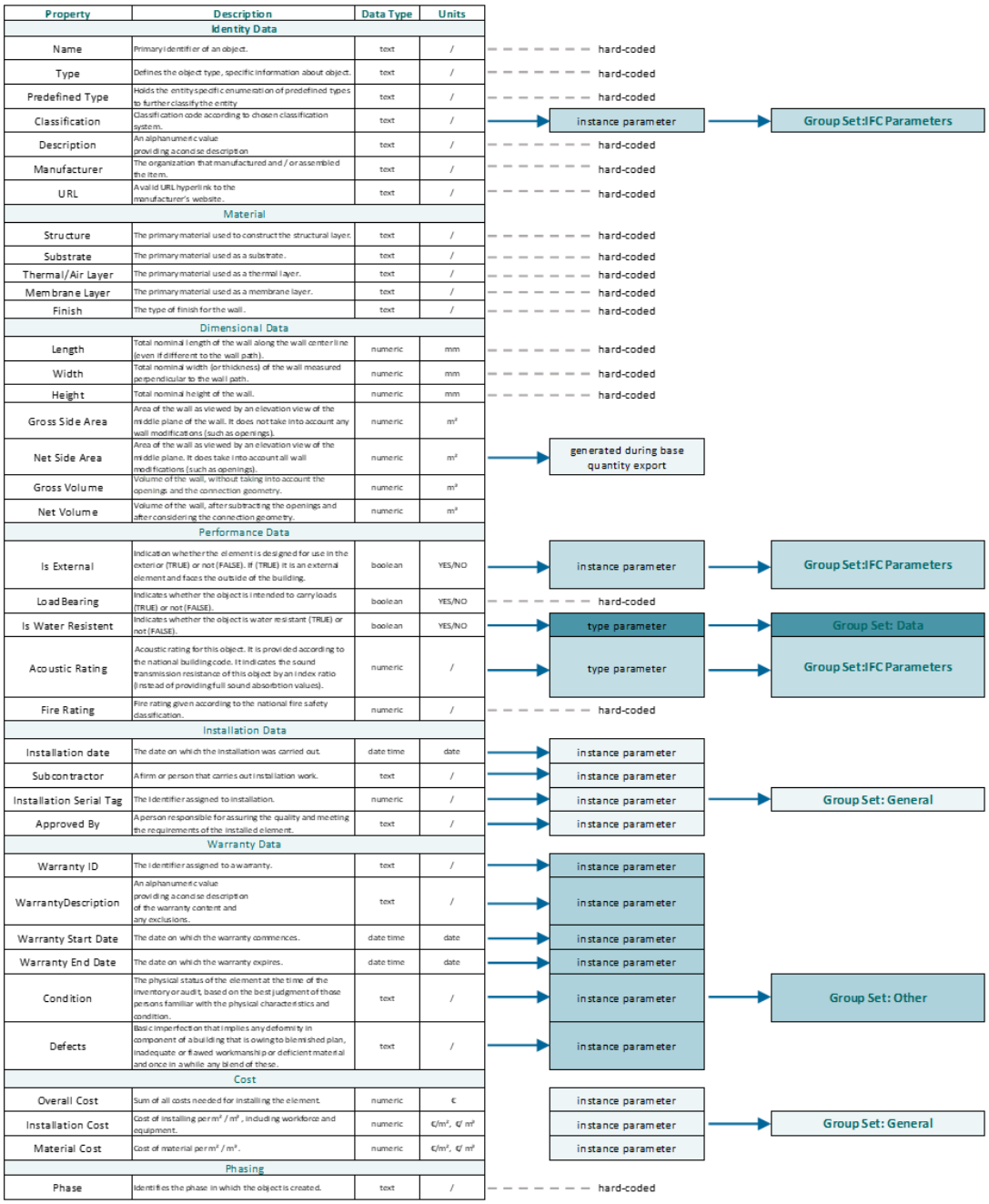

Figure 66 – Mapping parameters

Because of the limitation given by Revit when it comes to grouping properties and naming property sets, parameters were organized as follows: Cost and Installation Data grouped in the set named General; Warranty Data grouped in the set named Other; Is External and Fire Rating within the IFC Parameters and Is Water Resistant to property set Data.

Although the IFC export will change the distribution of parameters and locate them in sets according to the IFC schema, their organization within Revit file was important step in facilitating the overall process and ensuring easier navigation and input of the provided values for the users.

Since the file contains over 70 wall family types and over 1000 wall instances, Dynamo script and schedules were used to enhance the speed of populating parameters with the data. In the figure below section of populated data is shown (Figure 67).

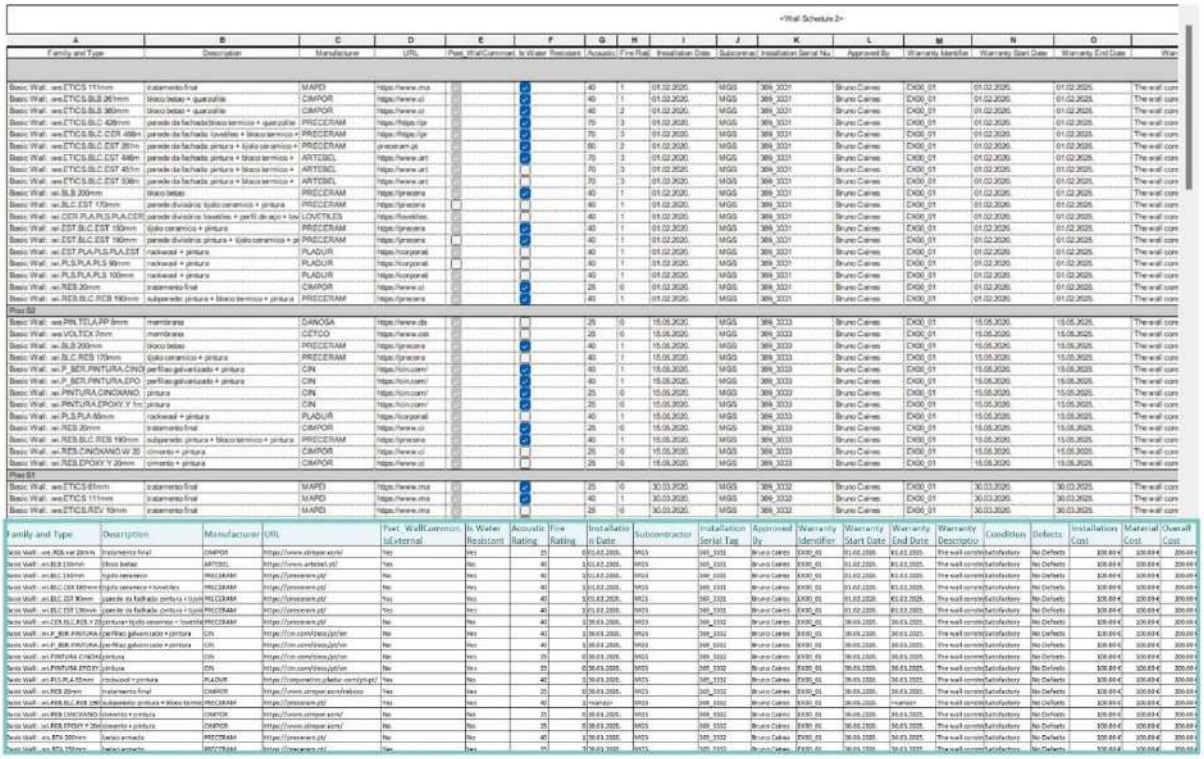

Figure 67 - Section of data populated within the Revit

5.7. Exporting to IFC

After populating the walls with required data, the model was exported to the IFC-SPF format. Assuring the data being properly exported involved several steps (Figure 68). Firstly, to check that all the walls are exported to IFC as IfcWall, and coverings made with wall object as IfcCovering. Secondly, exporting from the selected 3D view and selecting the option to only export elements visible in the view. Next step included adjusting the export of property sets where exporting of IFC common property sets and exporting of base quantities was selected. Along with these sets, user defined property sets were added to assure all the parameters being exported to the IFC. Chosen version was IFC4 Reference View and chosen classification system was Uniclass 2015.

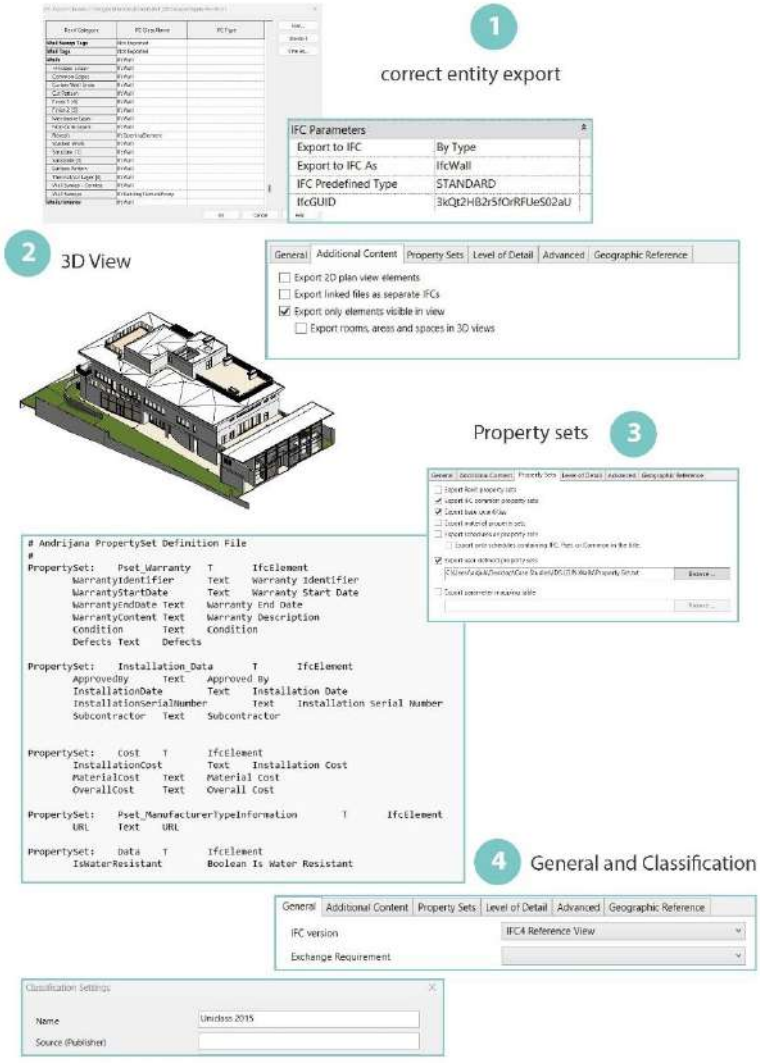

Figure 68 - Process of IFC export

Prior to checking the compliance of the file to IDS, IFC was evaluated in the BIMCollab viewer (Figure 69). Exploration of the file showed that all the parameters were effectively mapped and exported. Along with the alphanumeric information, quantities were also examined and compared to the ones displayed in the proprietary file, which showed no discrepancies.

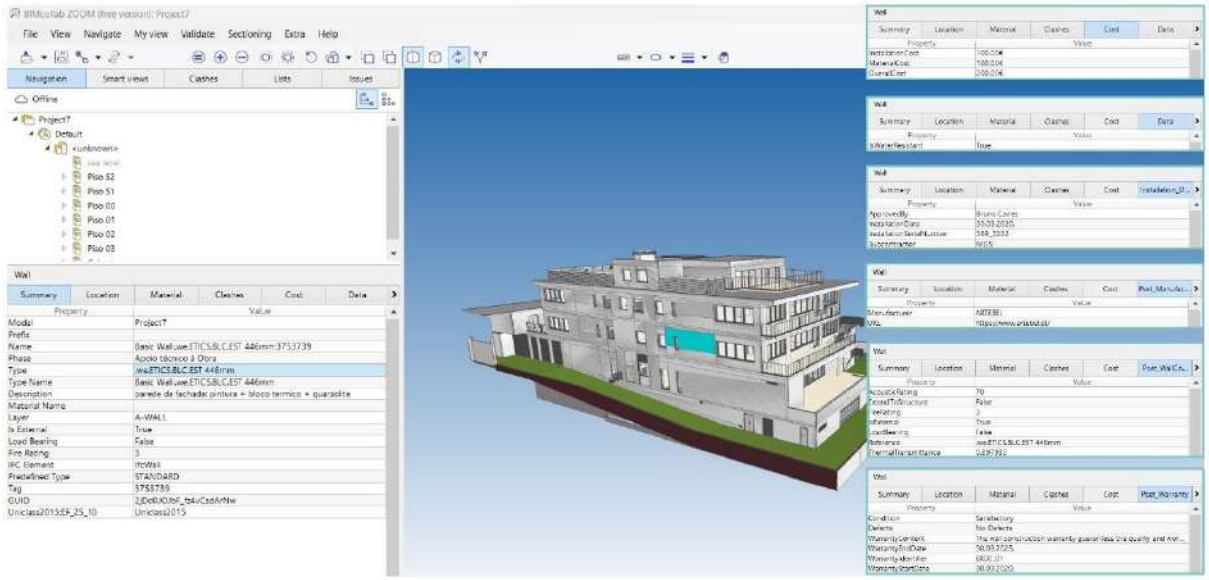

Figure 69 - Evaluation of IFC file within IfcViewer

5.7.1. IDS Converter and Blender BIM

Methodology chosen for this type of verification adopts an open approach, combining IDS converter with the functionalities provided by Blender BIM. IDS converter is an app developed by Carlos Dias (Dias, 2023) that is used to generate an IDS format as defined by BuildingSMART. Within Blender there is a BIM add on that contains functionality IFC Tester that is used to check the compliance of the IFC file to the IDS format. Process consists of three key steps, which are:

- Populating the Excel sheet with defined requirements – filling the template provided by the converter app;

- Using the IDS converter for generating IDS using the IDS converter app to transform Excel data into an IDS format and

- IFC compliance check with IfcTester - inside Blender BIM using the IfcTester feature to compare provided IFC file with the IDS.

Excel template is structured with columns each defining distinct aspect of the requirement. Being structured this way it provides easy navigation and user-friendly environment. Setup follows a structure as shown in the figure below (Figure 70).

specification name	name of the specification (necessary)
specification description	description (optional)
entity	IFC type (necessary)
predefined type	predefined type of the element (optional)
property name	property name
property type	data type of the requested property (necessary)
property set	name of the property set (necessary)
property value	value requested in the property (optional)
have restriction	if True-property needs to be matched by property value
restriction base	data type of property value (optional)
optionality	optionality of the property (necessary)

Figure 70 - Excel template structure

This structure enables the user to not only establish the properties that need to be retained within the model but to define and verify their corresponding values as well. This functionality proves particularly convenient when addressing specific property values such as fire rating. For instance, in this case it was requested to all solid walls have Fire Rating that is 3 and each wall to be approved by BIMMS.

These specifications were defined in the following way (Figure 71).

specification name	specification description	entity	predefined type	property name	property type	property set	property value	have restriction	restriction base	optionality
My_spec_12	Wall needs this properties	IFCWALL	SOLIDWALL	FireRating	IfcLabel	Pset_WallCommon	3	TRUE	integer	required
My_spec_17	Wall needs this properties	IFCWALL		ApprovedBy	IfcText	Installation_Data	Bruno Caires	TRUE	string	required

Figure 71 - Specifying the restrictions of the parameters values

Following the Template data structure, an Excel sheet is populated with the requirements (Figure 72) and then using the IDS converter, exported to IDS format.

specification name	specification description	entity	predefined type	property name	property type	property set	property value	have restriction	restriction base	optionality
Wall_Length	Wall needs this properties	IFCWALL		Length	IfcLengthMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Width	Wall needs this properties	IFCWALL		Width	IfcLengthMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Height	Wall needs this properties	IFCWALL		Height	IfcLengthMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Gross_Side_Area	Wall needs this properties	IFCWALL		GrossSideArea	IfcAreaMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Net_Side_Area	Wall needs this properties	IFCWALL		NetSideArea	IfcAreaMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Gross_Volume	Wall needs this properties	IFCWALL		GrossVolume	IfcVolumeMeasure	Qto_WallBaseQuantities		FALSE		required
Wall_Net_Volume	Wall needs this properties	IFCWALL		NetVolume	IfcVolumeMeasure	Qto_WallBaseQuantities		FALSE		required
Is_External	Wall needs this properties	IFCWALL		IsExternal	IfcBoolean	Pset_WallCommon		FALSE		required
Is_Water_Resistant	Wall needs this properties	IFCWALL		IsWaterResista	IfcBoolean	Data		FALSE		required
Is_Loadbearing	Wall needs this properties	IFCWALL		LoadBearing	IfcBoolean	Pset_WallCommon		FALSE		required
Wall_Acoustic_Rating	Wall needs this properties	IFCWALL		AcousticRating	IfcLabel	Pset_WallCommon		FALSE		required
Solid_Wall_Fire_Rating	Wall needs this properties	IFCWALL	SOLIDWALL	FireRating	IfcLabel	Pset_WallCommon	3	TRUE	integer	required
Wall_Fire_Rating	Wall needs this properties	IFCWALL		FireRating	IfcLabel	Pset_WallCommon	[0-9]	TRUE	string	required
Wall_Installation_Date	Wall needs this properties	IFCWALL		InstallationDa	IfcText	Installation_Data		FALSE		required
Wall_Installation_Serial_Nur	Wall needs this properties	IFCWALL		InstallationSer	IfcText	Installation_Data		FALSE		required
Wall_Subcontractor	Wall needs this properties	IFCWALL		Subcontractor	IfcText	Installation_Data		FALSE		required
Wall_ApprovedBy	Wall needs this properties	IFCWALL		ApprovedBy	IfcText	Installation_Data	Bruno Caires	TRUE	string	required
Wall_Warranty_Identifier	Wall needs this properties	IFCWALL		WarrantyIdent	IfcText	Pset_Warranty		FALSE		required
Wall_Warranty_Content	Wall needs this properties	IFCWALL		WarrantyCont	IfcText	Pset_Warranty		FALSE		required
Wall_Warranty_Start_Date	Wall needs this properties	IFCWALL		WarrantyStart	IfcText	Pset_Warranty		FALSE		required
Wall_Warranty_End_Date	Wall needs this properties	IFCWALL		WarrantyEndD	IfcText	Pset_Warranty		FALSE		required
Wall_Condition	Wall needs this properties	IFCWALL		Condition	IfcText	Pset_Warranty		FALSE		required
Wall_Defects	Wall needs this properties	IFCWALL		Defects	IfcText	Pset_Warranty		FALSE		required
Wall_Installation_Cost	Wall needs this properties	IFCWALL		InstallationCo	IfcText	Cost		FALSE		required
Wall_Material_Cost	Wall needs this properties	IFCWALL		MaterialCost	IfcText	Cost		FALSE		required
Wall_Overall_Cost	Wall needs this properties	IFCWALL		OverallCost	IfcText	Cost		FALSE		required

Figure 72 - Specifications defined in the Excel template

One of the issues encountered following this approach to create IDS is that the Excel template only addresses parameters that are stored as properties within property sets. This means that all the information such as classification, materials, description and GUID cannot be added directly to the table. Which raises the question can parameters that are stored as attributes and in higher-level entities also be submitted to evaluation? To answer this question, it was needed to delve into the documentation of both IDS format, IDS converter and IfcTester. First IDS format's Github repository was evaluated. Documentation provided there which includes both Property-facet, Attribute-facet and Material-facet proved that IDS format itself is designed to handle both attributes and properties, as well as materials. This finding led to conclusion that limitations encountered have to be either by converter or the tester. Going further, IDS converter's repository was evaluated. The investigated documentation revealed that the limitation is deriving from the converter's functionality, which posed another question: is there a way to go around this limitation? The proposed methodology would be to follow the steps of populating Excel sheet, then using the converter to export the IDS, and then manually add to the code, requirements that cannot be directly exported with the template. This approach was tested with adding classification requirement manually (Figure 73), which proved to be working.

```
519         </specification>
520         <specification name="My_spec_27" ifcVersion="IFC4" description="All Walls need to be classified" minOccurs="0" maxOccurs="unbounded">
521             <applicability>
522                 <entity>
523                     <name>
524                         <simpleValue>IFCWALL</simpleValue>
525                     </name>
526                 </entity>
527             </applicability>
528             <requirements>
529                 <classification>
530                     <system>
531                         <simpleValue>Uniclass2015</simpleValue>
532                     </system>
533                 </classification>
534             </requirements>
535         </specification>
536     </specifications>
537 </ids>
```

Figure 73 - Adding classification specification to the code

After creating the IDS, IfcTester was used to conduct the assessment of the IFC file to the established IDS. The outcome of the verification is elaborated upon below (Figure 74).

Figure 74 - Results of performed check

The results obtained from the verification process demonstrate high level of compliance. As it can be seen on the provided results, majority of verifications provided 100% accuracy, meaning that all 1163 IfcWall entities comply to the specified IDS requirements. However, certain difficulties emerged particularly in relation to the quantity properties. 97% of the evaluated walls were marked as passing the prescribed requirement. A closer examination of the results revealed that 33 walls did not contain required properties: Height, Gross Volume and Gross and Side Net Area. To address this issue, further

inspection of IFC model in the BIMCollab platform was conducted. Based on the GUID of the walls provided in the results, Smart view was created to isolate only the walls showing discrepancies (Figure 75).

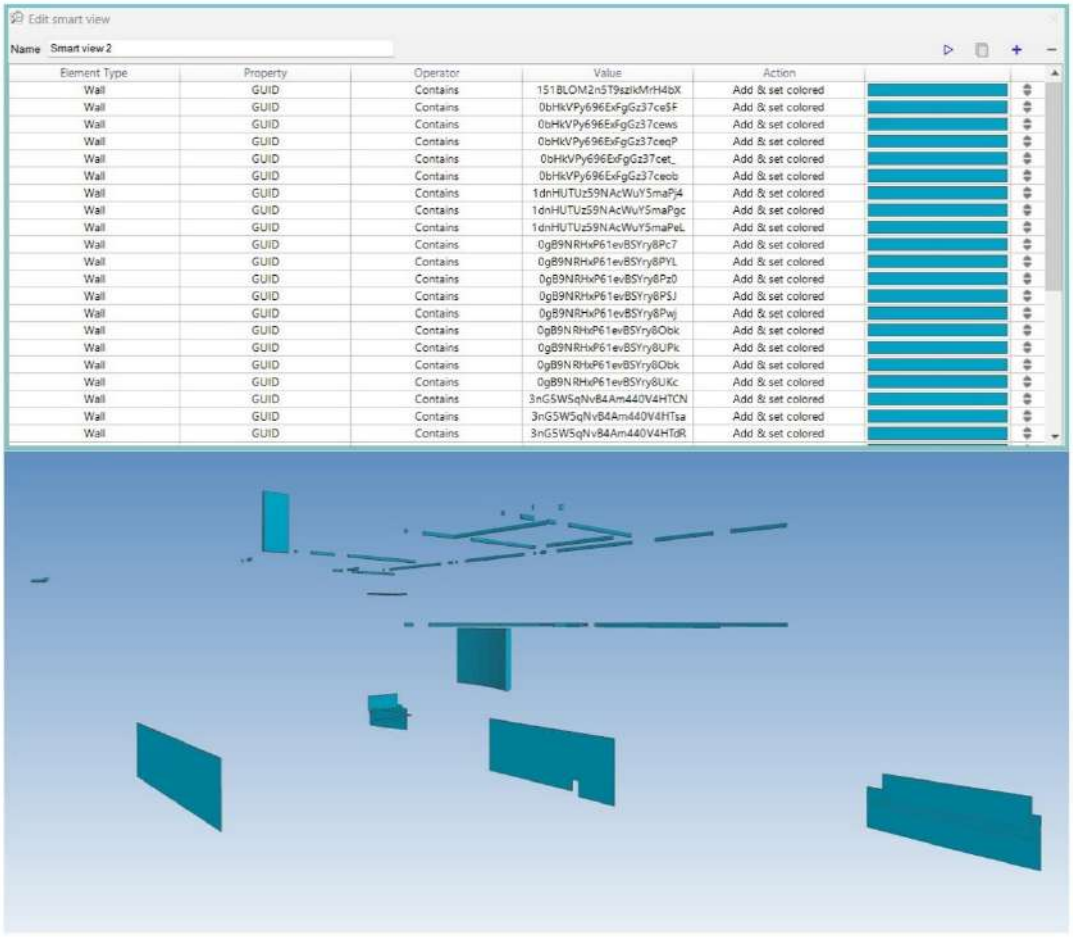

Figure 75 - Visualization of results within IfcViewer

Based on the evaluation of the selected walls, it can be concluded that possible reason for an issue during the export of the base quantity set could be due to their geometry. Further investigation on the possible issues during IFC export provided no answer on why this happens, only that the possible problem could be related to the conversion of units. Having this in mind, it is recommended to adopt slightly different approach in cases where geometric complexity of the walls could pose the challenge during the export of the data. In such case, it is advised to consider data mapping as opposed to relying on the automated generation through the base quantities export.

5.7.2. ACCA IDS Editor and IDS Validator

Second approach to using IDS format for checking IFC file compliance to the requirements, relies on the tools developed by ACCA software. Methodology is based on the use of two tools:

usBIM.IDS editor - a tool used to specify information requirements and convert them into a standard IDS file, which will be used for validation. It is an open online application that can be used by everyone.

usBIM.IDS validator - this tool checks the IFC file against the IDS format created previously. Finally, it verifies if the provided IFC file meets the requirements outlined in the IDS.

Both tools are integrated into the usBIM cloud system.

As explained in the previous chapter, this verification methodology will use wall instances as a subject of study, so the initial step is to create an IDS format that specifies all information that should be contained within the wall. Advantage of ACCA's editor compared to the previous inspected methodology is that it allows creation of requirements for not only properties, but classification, material and attributes as well. The tool has built in functionality to recognize IFC relationships and entity inheritance, so specifying attributes only requires defining their name, without further knowledge of their position in the IFC schema. Based on the way how IFC stores required information, parameters were organized under four groups: Classification; Attributes; Materials and Properties.

Furthermore, following this division they were specified in the editor as shown in the examples below (Figure 76).

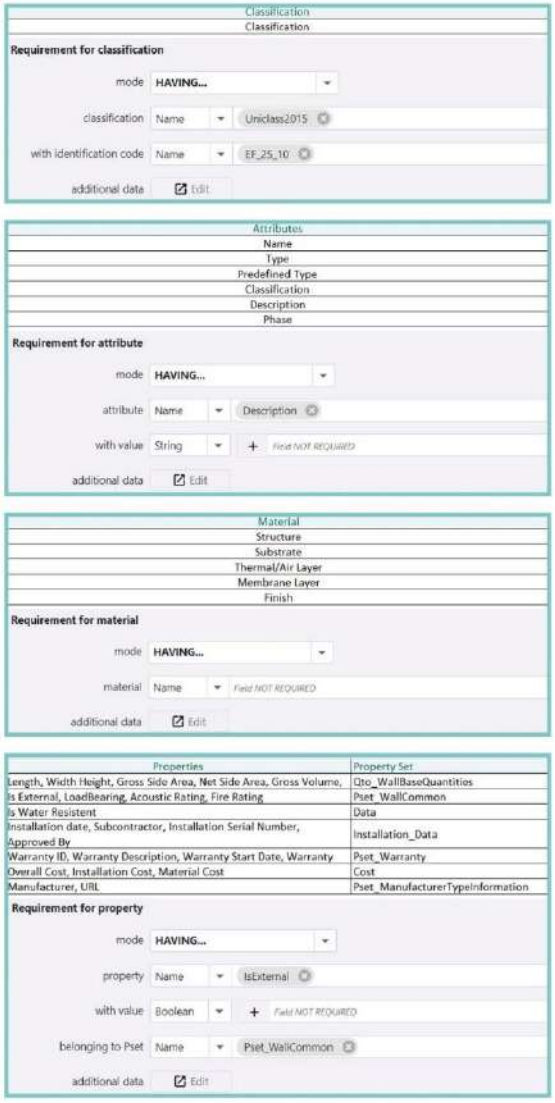

Figure 76 - Specification of requirements in editor

One of the functionalities of editor is that it allows defining range of values or the exact value within the property. Which, in this case, was used to specify that all fire rating values should be in the range of 0 to 9. Additionally, a specific requirement was set by which all wall elements need to be approved by BIMMS.

During the process of creating IDS, couple of issues were noticed, which was confirmed by the later inspection of the IFC schema. It turned out that attribute Phase has no direct relation to the IfcWall. Meaning that, it can be assessed only as the attribute within IfcProject which is the entity where this data is stored. Furthermore, an issue was noticed in specifying the exact name of the material. While this is straightforward when an element comprises a single material, it leads to a question when dealing with compound elements that consist of multiple layers. To answer this question, research of both editor's and validator's documentation was undertaken. It was discovered that it is possible to specify the naming of each material layer and should be in a format as exemplified in the Figure 77. Naming process follows a specific schema: <wall name>, <structural layer name>, <Materials>, <material layers>, excluding the membrane layer since it has no thickness. However, this approach is very time consuming especially when dealing with elements containing a substantial number of layers. So, it is advised to be applied only when elements comprise a single layer or limited number of material layers.

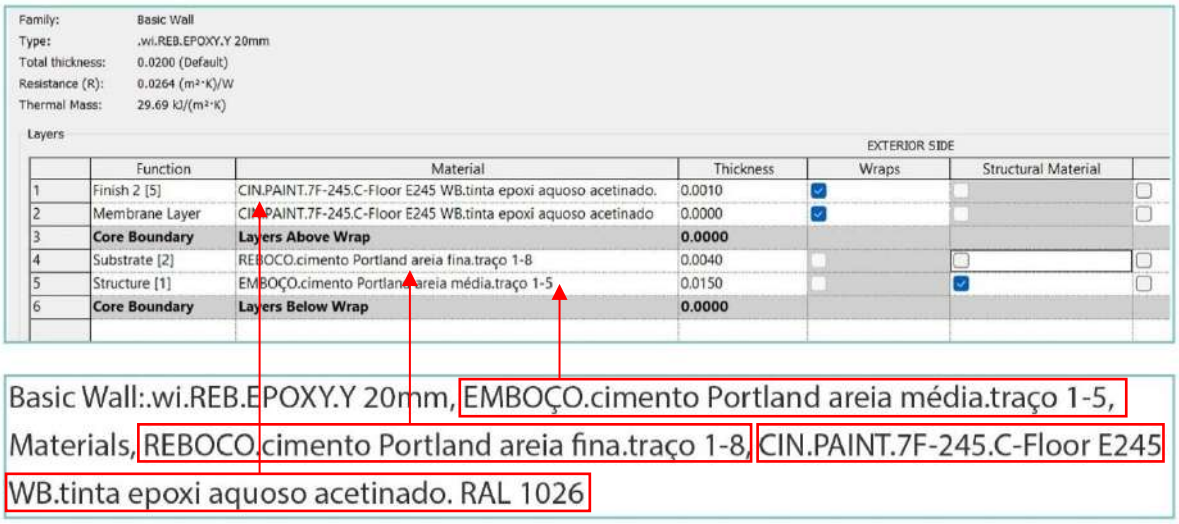

Figure 77 - Schema for specifying naming of material

After preparing the IDS format, validator was used to conduct verification. Results of the checking showed that all 1163 wall instances satisfy classification requirement, as well as majority of the information requirements. The issue was detected with the base quantities, where the results match the results provided by the previous verification method. 33 wall instances are missing Height, Gross Side Area, Net Side Area and Gross Volume (Figure 78).

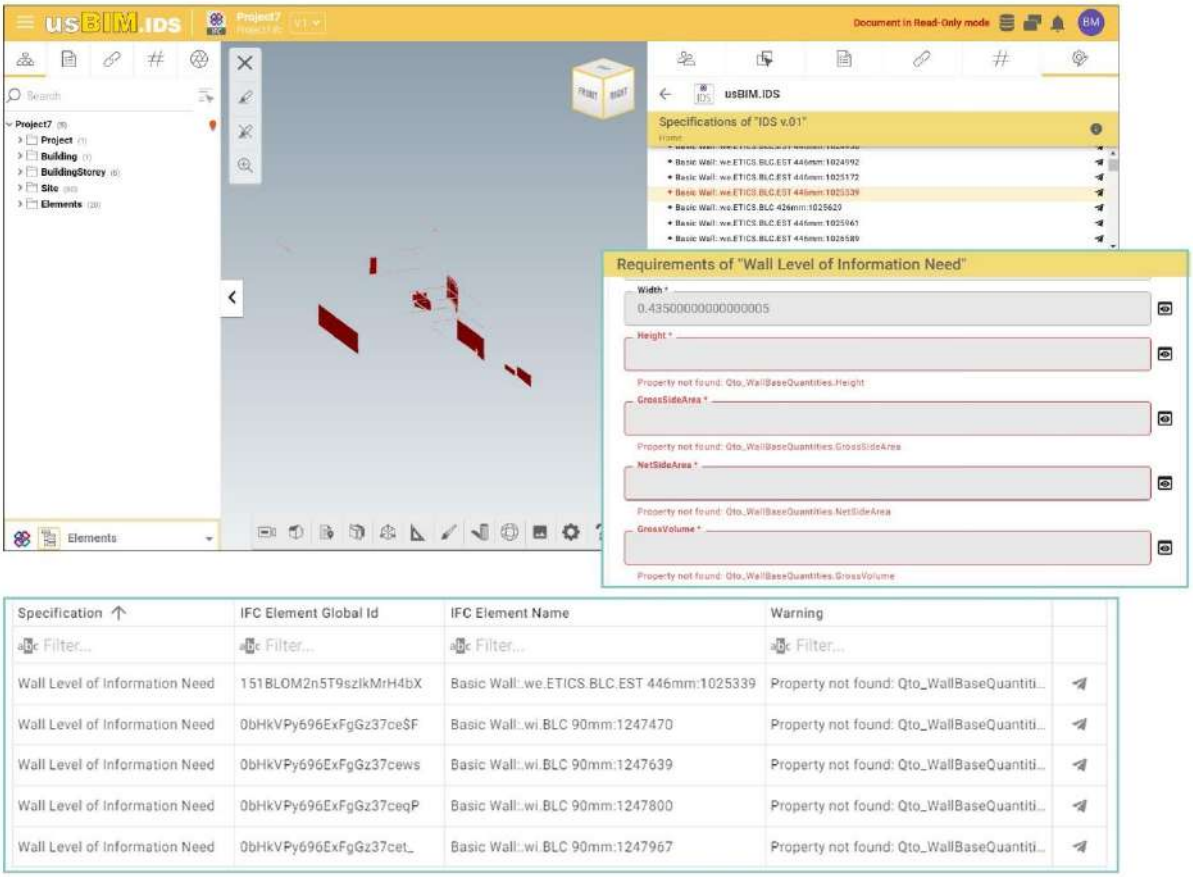

Figure 78 - Results of performed check within validator

5.8. Comparison of the methods for verification

When evaluating optimal verification methodology for specific use case, it is crucial to understand their distinctive advantages and limitations. In this context, Dynamo serves as a tool specifically intended for direct checking of the Revit model. This allows uninterrupted workflow, eliminating the need for additional steps of exporting required by majority of model checkers. Additional step in integrating Dynamo in a quality assuring process would be automation of the issue correction, which would significantly reduce time and resources lost in these processes. In scenarios where discrepancies are identified within model checker, identified issues are manually or semi-automatic transferred from the checker to the Revit environment, and subsequently handled. Integration of Dynamo would allow automation of error detection and correction within the authoring platform. Advantages of using this tool is its user-friendliness, and its applicability on different models. Opposed to this, IFC-related verifications are highly dependent on the version of the IFC, and the way data is structured within IFC schema, which sometimes limits the use. When evaluating the IfcOpenShell and IDS verification methodologies, several factors are observed. Primary limitation of the use of IfcOpenShell is that it requires prior programming experience, but also deep knowledge of the IFC schema. Nevertheless, it allows much faster processing of bigger amount of data and enables performing geometry checking that with IDS can only be performed to certain extent, through defining property values. In contrast, biggest advantage of the IDS format in both tested approaches is that is accessible and fairly easy to apply. Comparison of two tested methodologies using IDS undoubtedly shows an advantage in the use of

converter and BlenderBIM since it is a completely open approach. Although the converter displays certain limitations in its ability to specify requirements, this constraint can be overcome with relatively straightforward code modifications. ACCA's editor is far more advanced in formulating IDS, but differences between IfcTester within BlenderBIM and IDS validator are minor. Key advantage of validator is that it enables visual identification of the elements and facilitates export of the BCF file that can be used to address the issue further. In summary, all verification methods offer unique benefits and challenges, meaning multiple factors should be considered when deciding which one to use.

6. CONCLUSIONS

Quality Management is a fundamental principle for addressing quality of products or services. Its evolution can be traced back starting from the ancient civilizations to the 4th industrial revolution, otherwise known as Industry 4. Digital transformation brought by Industry 4.0 facilitated the need for Quality 4.0 which is a new approach in managing quality, that relies on the use of digital technologies, particularly automation, to enhance quality control. This research identified various benefits on the use of Quality 4.0 tools in the Quality Management processes, which underlines the significance of embracing this approach for staying competitive in currently evolving digitalization.

When it comes to construction industry, process of managing quality presents a unique challenge. This complexity arises from the involvement of large number of various stakeholders and the nature of the construction projects, which is unpredictable and always changing. Quality Management addresses not only the final product, but the processes as well. With the implementation of BIM, Quality Management in the AEC sector has experienced drastic transformation, shifting from the traditional on-site procedures to the managing quality in digital environment. With the digital model becoming key factor of project development and collaboration between stakeholders, the focus of quality managing methodology was redirected to it. This facilitated two processes that address quality of the model: Quality Assurance and Quality control. For proper Quality Management within BIM environment, it is of crucial importance to understand how these processes function and what their core differences are. Numerous guidelines and manuals are available on the topic of model quality, providing an insight into the status of QA/QC practices on the market. It was evaluated the extent and detail to which they address these topics, confirming that majority of provided documents lack clear and detailed guidelines to achieve model quality.

The key component of QA/QC processes within BIM represents model checking. Despite the obvious benefits, there are still a lot of challenges in the efficiency of its application. It is usually very complex process and users are often reluctant to trust the results. To perform model checking three components must be addressed, the predefined rules, the information content and the tool used for checking. To provide better understanding of the model checking processes and to evaluate solutions available on the market, several software solutions and their functionalities were analysed.

Putting in BIM context the overall definition of quality as conformance to requirements, leads to the conclusion that model quality can be measured in its ability to fulfil intended purpose. Meaning that QA/QC processes should be focused on the compliance of the model to the predefined requirements. Requirements given by the appointing party are the ones defining main objectives and purpose of the model. If the model fails to achieve its purpose, it is a faulty product. One of the main challenges found in proper defining of the requirements is that client lack the proper knowledge on how to specify the requirements comprehensively. This facilitates poor inputs that result in poor model quality. Interviews conducted within the company confirmed that lack of clarity and detail represent main issues with client's specification of the requirements.

This research has recognized that improving quality of BIM model requirements can answer the question on how the model quality can be enhanced. It is proposed a solution that suggest an implementation of

the methodology that would address the way how clients specify requirements and how the BIM model is verified according to those requirements. This methodology is based on the understanding that the accuracy, precision, and comprehensiveness of the model requirements are critical to the development of a BIM model. It was developed a Specificator that would assist the appointing party in the process of defining Project specific requirements. This would prevent the issues deriving from inadequate information. Project specific requirements are then delivered to the appointed party and used for the creation of the model. For assuring model quality, verification methods are included, validating the model's compliance to the predefined requirements. This reduces potential issues and improves the interoperability process.

To construct the Requirements Specificator, extensive research was conducted. The research phase began with data collecting approach using a variety of methods and sources. In order to ensure that the Specificator's content is based on the wide range of industry guidelines, standards and best practices, the initial phase was parsing through large number of different resources. This resulted in the collection of data that captures collective knowledge on this subject. Furthermore, study project involved collecting valuable information and expertise shared in the interviews with company's professionals. This resulted in not only gaining professional insights, but also aligning methodology with company's operating methods. The research journey further extended into a revision process, once again involving company's professionals. This revision phase was crucial step in fine-tuning the initial draft of the Specificator. It provided validation of the content. Finally, the first version of the Requirements Specificator was created.

In addition to the creation of Specificator, this research also addressed possible methods of verification of the model compliance to the rules defined by the requirements. The verification approach was aligned with the tendencies of using advanced technologies outlined previously. Possible methods were tested on the case study provided by the company. The verification approach tested three methods using visual programming language, IfcOpenshell and IDS format. Performed verifications showed that each tool has its benefits and drawbacks in terms of checking the BIM Model. However, in the wider scale application of these methodologies, choosing appropriate one depends on a set of variables that should be considered: resources, programming expertise, financial aspects and so on.

The concept of integrated QA/QC methodology proposed in the research holds great potential in addressing quality and assuring that the BIM model answers to the client's needs. It has the capacity of transforming the process of collaboration and the way deliveries are handled. However, the implementation of this approach to its full potential would require extensive financial and human resources for development. Firstly, in completing the knowledge base with more BIM uses so it can respond various scenarios. Related to this, Specificator would require continuous refinement aligning it with current standards and incorporating lessons learned from each project. Secondly, in creating the tool that would accommodate all verifications of the requirements from the Specificator.

The conducted research led to the development of a proposed methodology aimed at enhancing the quality of the model. Anyway, it is important to note that there are opportunities for further development and expansion of this methodology aimed at enhancing the range of its functionalities and overall efficiency. Further developments of the study could enhance proposed Specificator in several ways:

- Enlarging the Requirements Specificator by adding more parameters and requirements to the existing tiers. Specificator may meet a bigger variety of project-specific requirements by including wider range of criteria. Third tier may also be expanded to cover new BIM uses, assuring its applicability in wider range of project scenarios.

- Creating a Preparator that would allow automatic generation of the project specific requirements. Instead of manually creating a subset from the Specificator, this transition would work using machine to machine interaction, where the subset of all requirements would be extracted based on the user inputs in the Preparator. For example, in the Preparator client could select the type of building, project milestone, requested uses and other relevant details. The Preparator would then extract the necessary parameters and requirements from the Specificator's repository, creating a customized set of requirements for the specific project. Automation of this process would allow seamless transition of information from the preparator to the requirements specification, reducing the possibilities of errors or omissions.

- Verification methodology can be enhanced by developing a comprehensive verification process that encompasses all the specified requirements. The verification process would include both internal quality checks, as well as validation on the client's side. Final objective would be automation of verification process, using advanced algorithms and tools.

- Development of Web-Based Platform could facilitate the entire methodology, integrating all the components. This platform would involve the Preparator where project specific requirements would be generated, and a Tester where the digital model would be verified against these requirements. The platform would streamline the workflow by providing centralized environment for managing the quality assurance and checking processes. Results and reports would be automatically generated, allowing both appointing parties and appointed parties to access the results and communicate the issues.

The ultimate goal for further development would be to utilise Specificator machine to machine structure and allow automation of the creation and verification process, minimizing manual work and allowing seamless process.

The findings of this research underline the importance for the industry to prioritize Quality of the BIM Models. Although there is the large number of guidelines and tools available on the market, the depth with which they deal on the topic of Quality is not sufficient. They provide either very ambiguous guidelines or the ones not applicable in real world market, discouraging users in adopting them. With this in consideration, it becomes imperative to shift the focus towards methodologies that are straightforward, and applicable in practice. Moreover, the fragmentation of Quality procedures needs to be prevailed by integration, as it is the only possible way in striving for seamless processes.

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LIST OF ACRONYMS AND ABBREVIATIONS

AEC	Architecture, Engineering and Construction
AIR	Asset Information Requirements
BEP	BIM Execution Plan
BERA	Building Environment Rule and Analysis Language
BIM	Building Information Modelling
EIR	Exchange Information Requirements
GUID	Global Unique Identifier
IDS	Information Delivery Specification
IFC	Industry Foundation Class
LOD	Level of development
LoD	Level of detail
LOIN	Level of Information Need
MEP	Mechanical, Electrical and Plumbing
MVD	Model View Definition
OIR	Organizational Information Requirements
OWL	Web Ontology Language
QA	Quality Assurance
QC	Quality Control
QTO	Quantity take-off
RASE	Requirement, Applicability, Selection and Exception
RDF	Resource Description Framework
SASE	Standards, Analysis, Synthesis and Evaluation

APPENDICES

APPENDIX 1: I TIER: GENERAL PROJECT REQUIREMENTS

REQUIREMENTSSpecificator - General Project Requirements

	GENERAL PROJECT REQUIREMENTS
1	**Agreed Version**
	All models shall be modelled in the same version of the required tool.
2	**BIM File Naming**
	All files within the project shall follow uniform and consistent naming convention specified by the information requirements.
	* If not requested otherwise, the ISO 19650-2 naming convention may be followed.
	Project Code><Originator<>Functional Breakdown<>Spatial Breakdown<>Form<>Discipline<>Number
	Project Code – individual code for the project e.g., SC1
	Originator – unique code for the organization creating information e.g., SFT
	Functional Breakdown – design purpose of the information e.g., fire protection information
	Spatial Breakdown – spatial location of information e.g., first floor building level 01
	Form – defining form of information
	D-drawing
	G-diagram
	I-image
	L-list
	M-model
	T-textual
	V-video/audio
	Discipline – technical activities
	A-Architecture
	B-Building surveying
	C-Civil engineering
	D-demolition/dismantling
	E – Electrical Engineering...
	Number – used for differentiation by allocating a sequential number
	*General rules
	Avoid using special characters in fields and folders \ / : * ? " < > | [ ] & $, . { } @
	All fields shall be separated by a hyphen character.
3	**Classification System**
	All elements shall be assigned classification code and follow the same classification system e.g., Uniclass 2015.
4	**Unique GUIDs**
	All components shall have unique GUID values.
5	**Project Information**
	Project Information shall be defined:
	Project Name;
	Project Adress;
	Project Number / ID;
	Client Name and
	Author. /
6	**Project Units**
	Relevant measurement units shall be defined at the Project level of each model.
	Metric system is used unless required otherwise.
7	**Consistency of Units**
	All discipline models shall follow the same measurement system.

REQUIREMENTSSpecificator - General Project Requirements

12	**Project BasePoint**
	Project Base Point shall define the origin (0,0,0) of the project coordinate system.
	Location of the Project Base Point shall be the same for all discipline models.
13	**Orientation**
	Project North in all discipline models shall be the same.
	True North direction in all discipline models shall be the same.
	Angle between Project North and True North shall be the same in all discipline models.
14	**Level Structure**
	All models shall use the same level structure.
15	**Grids**
	Grids shall be consistent across all discipline models.
16	**Unused Elements**
	Models shall not contain unused elements.
17	**Linked Revit Files**
	Linked Revit Files shall be pinned in place.
18	**Linked CAD Files**
	Linked CAD Files shall be pinned in place.
19	**In-Place Families**
	Using In-Place Families should be avoided.

APPENDIX 2: II TIER: ALPHANUMERICAL REQUIREMENTS

REQUIREMENTSSpecificator - Alphanumerical Requirements

1	**Level Naming**

All levels shall follow a uniform and consistent naming convention specified by Information requirements.
If not requested otherwise, ISO 19650-2:2018 may be followed:
Using a two-digit sequential numbering system.

ZZ - Multiple Levels
XX - No Level Applicable
GF - Ground Floor
0 - Base level of building (where ground floor is not appropriate)
1 - Floor 1
2 - Floor 2
M1 - Mezanine above level 01
M2 - Mezanine above level 02
B1 - Basement level 1
B2 - Basement level 2

2	**View Naming**

View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements.
If not requested otherwise, View Naming may follow the schema:
Level (Optional)<>Content
Level-description of the content and purpose of the view
Content-further clarification of the information shown
e.g., LEVEL 1-FLOOR PLAN

3	**Callout View Naming**

View Naming shall be uniform and consistent following the Naming Convention requested by the Information Requirements.
If not requested otherwise, View Naming schema may be applied. If the View refers to a fabrication detail, Classification code may be applied in the naming e.g.,
Pr_20_65_60_17 : Cross-laminated timber (CLT) paneled module

4	**Object Naming**

All objects shall follow the same naming convention specified by the Information requirements.

If not requested otherwise, BS 8541-1:2012 may be followed:

For objects that already carry classification information as data in its attributes:

Source>_<Type>_<Sybtype/Product code

Source - library author or manufacturer;
Type - type of object;
Material – material type;
Subtype/Product code – conveys additional information;

For objects that do not carry classification information:

Role>_<Classification>_<Presentation>_<Source>_<Type_<Sybtype/Product code

Role - role of the object owner;
Classification - Either a functional or product classification code;
Presentation - role of the object owner;
Source - library author or manufacturer;
Type - type of object;
Subtype/Product code – conveys additional information.

REQUIREMENTSSpecificator - Alphanumerical Requirements

	Originator>_<Source>_<Type>_<Sybtype/Product code>_<Diferentiator
	Originator - conveys object provider by a 3–6-character code; Source - library author or manufacturer; Type - type of object; Material – material type; Subtype/Product code – conveys additional information; Differentiator – conveys additional information.
5	**Material Naming**
	All materials shall follow the same naming convention.
6	**Property Occurrence**
	Each BIM object shall have only one occurrence of the property. *In case of duplication, hard-coded properties have precedence.
7	**Property Units**
	All property units shall be consistent and following metric system, if not specified otherwise.
8	**Unique Property Naming**
	Each unique information describing the object shall contain a unique property name.
9	**Property Naming**
	Properties shall be named in consistent and human-readable way. *Boolean properties that require Yes/No answer shall be named to clearly indicate the Yes/No answer e.g., IsExternal. *Properties shall not contain units, unless required. *Property values shall not finish with a stop. *If property contains a range value, it shall be separated using a hyphen e.g., 300-350.
10	**Property Value**
	Properties shall have defined values where known. *Values can be defined as: fixed - only one value available; range - lower and upper boundary provided; enumerated - number of values provided and formula - value relying on another property value.
11	**Unique Room Naming**
	There shall be no rooms containing the same naming.
12	**Space and Room Naming**
	Space and Room Naming shall be the same as the naming defined by the program.
13	**Consistency of Levels**
	Naming of the levels shall be consistent in all discipline models.

APPENDIX 3: II TIER: GEOMETRICAL REQUIREMENTS

REQUIREMENTSSpecificator - Geometrical Requirements

	GEOMETRICAL REQUIREMENTS
1	**Published models**
	Published models shall not contain model objects of other disciplines, even if they were used as reference.
2	**Lost Elements**
	Element placed on distance bigger then xx in x,y,z direction from the grid borderlines shall be considered a lost element.
3	**Duplicated Elements**
	Model shall not contain identical instances in the same place.
4	**Mirrored Elements**
	Model shall not contain mirrored instances of loadable components.
5	**Elements Intersection**
	Model shall not contain elements that overlap / intersect.
6	**Elements Location - Doors/Windows**
	Windows and doors shall be assigned to the same floor as the walls or roofs in which they are located.
7	**Elements Location - Doors Host**
	Interior doors shall be placed in interior walls and exterior doors shall be placed in exterior walls.
8	**Elements across multiple storeys**
	Elements should not be modelled continuously across multiple storeys.
	*Exception: Elements that are constructed as continuous i.e. in situ poured shafts
	Elements modelled across multiple storeys shall be referenced to the lowest story on which they appear.
9	**Unallocated / Unplaced Space**
	Model shall not contain spaces that are not placed.
10	**Redundant Space**
	There should be no spaces overlapping.
	Spaces shall not cross each other horizontally or vertically.
11	**Space Modelling**
	Spaces shall be directly adjacent to surrounding walls / other space components, floor below and ceiling finish / structural slab.
12	**Unallocated / Unplaced Rooms**
	Model shall not contain rooms that are not placed.

REQUIREMENTSSpecificator - Geometrical Requirements

13	**Redundant Rooms**
	There should be no rooms overlapping. *If there is no element to be zone boundary, room separation lines should be used.
14	**Room Area**
	Room Area shall be the same as the area required and defined by the room Schedule.
15	**Space Area**
	Space Area shall be the same as the area required and defined by the space program.
16	**Sloped Floor**
	Modelling sloped floors that exceed levels continously should be avoided. *It is advised to create independent sloped floor in each level with the meeting points of the floors being at the upper and lower edges of the levels.
17	**Structural Elements Connection**
	Structural connections should be modelled.
18	**MEP Elements Connection**
	There shall be no unconnected MEP elements.
19	**Elements not within rooms/space**
	Instances of furniture should be located inside the room/space.

APPENDIX 4: II TIER: DESIGN SPECIFIC REQUIREMENTS

REQUIREMENTSSpecificator - Design Specific Requirements

	DESIGN SPECIFIC REQUIREMENTS
1	**Element size**
	Wall height should not be less than 300mm.
	Window width should not be less than 100mm.
	Door width should not be less than 800mm.
	Door height should not be less than 2000mm.
	Staircase width should not be less than 900mm.
	Slab thickness should not be less than 100mm.
	Roof thickness should not be less than 100mm.
	Column profile diameter/width should not be less than 50mm.
	Beam profile width should not be less than 50mm.
2	**Clearance in front of Doors/Windows**
	Interior Doors - Minimal clearance in front of the door shall not be less than 900mm.
	Exterior Doors - Minimal clearance in front of the door shall not be less than 1200mm.
	Emergency Exit Doors - Minimal clearance in front of the door shall not be less than 1200mm.
3	**Clearance in front of the Toilet**
	Minimal distance between axis of the water closet and compartmentation wall shall not be less than 450mm.
	Minimal distance between the front edge of the water closet and other elements shall not be less than 533mm.
4	**Entrance Landings**
	Door maneuvering clearances shall not overlap with ramp landings.
5	**Minimal Room height**
	Minimal height measured from the top of the floor finish to the bottom of the ceiling finish shall not be less than 2.20m.
6	**Minimal handrail height**
	Minimal handrail height for stairs and ramps shall not be less than 900mm.
7	**Low Points**
	Low Points should be avoided.
	*so that impurities would not collect in those points - ducts,drainlines,gasslines depending on type of gass
8	**Drainline Slope**
	Drainlines shall have slope that allows self-drainage.
	*minimal slope 1-100

REQUIREMENTSSpecificator - Design Specific Requirements

9	**Piping Insulation**

Insulation type and dimensions shall be in accordance to information requirements.

*Minor clashes between insulation and other elements are tolerated.

10	**Equipment Vacum Line**

Equipment Vacum Line shall follow the fastest possible route to minimize the number of bends i.e., energy loss.

11	**Popout Sharing Criteria**

Different tools should not share the same popout.

* Matrix for popout sharing

	Dry Mechanical	Wet Services	Hot Duct	Heat Traced Lines	Electrical Services
Dry Mechanical	yes	yes	yes	yes	yes
Wet Services	yes	yes	yes	yes	no
Hot Duct	yes	yes	yes	yes	no
Heat Traced Lines	yes	yes	yes	yes	no
Electrical Services	yes	no	no	no	yes

12	**Spool Pipe sizing**

Maximum pipe length shall be 6m.

Maximum pipe length with two bends shall be 3m.

Maximum pipe length with more than two bends shall be 1.5m.

13	**Layers**

All layers and colouring shall be consistent according to information requirements.

14	**Valve handles**

Valve handles shall be designed to be accessible.

15	**Routing**

All services shall run inside their designated area defined by space management rules.

16	**No crossing lines in fab**

There should be no lines crossing in the technical area near the main equipment.

*Main equipment surroundings should be as neat as possible.

17	**Steel / Copper Piping**

Piping sizes 1/4, 3/8 and 1/2 should use bending angles and not fittings.

*Bends to be made in 15 degrees increment. Preferably 45° and 90°.

18	**Line Numbers**

Line numbers shall be assigned to the corresponding lines.

19	**Line Numbers Naming**

All line numbers shall follow the same naming convention

20	**Piping length dimensions**

All piping lengths shall be rounded to whole numbers or with decimal component 0.5.

21	**Field Connection**

All prefab elements shall contain the marking of the location of the joints.

APPENDIX 5: II TIER: LEVEL OF INFORMATION NEED

REQUIREMENTSSpecificator - Architectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Wall" / IfcWall			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m²
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Cost			
	Estimated Unit Cost	Estimated cost of element per m² / m³ . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Wall" / IfcWall			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. Penetrations are modelled to nominal dimensions for major wall openings and large mechanical elements.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m²
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m²
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m³
	Net Volume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Is Water Resistent	Indicates whether the object is water resistant (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Wall" / IfcWall			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to rough-opening dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m²
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m²
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m³
	Net Volume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Is Water Resistent	Indicates whether the object is water resistant (TRUE) or not (FALSE).	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values).	numeric	/
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"CurtainWall" / IfcCurtainWall			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness. Nominal thickness of glazing and size and spacing of the mullions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"CurtainWall" / IfcCurtainWall			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. Mullion shapes and geometry defined.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values).	numeric	/
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"CurtainWall" / IfcCurtainWall			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All interface details modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Total nominal height of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values).	numeric	/
	Fire Rating	Fire rating given according to the national fire safety classification.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Floor" / IfcCovering			
Geometrical information:				
Detail:	Simplified volume representation modelled to the overall thickness. Major openings modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m^2
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Has AntiStatic Surface	Indication whether the surface finish is designed to prevent electrostatic charge (TRUE) or not (FALSE).	boolean	YES/NO
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Floor" / IfcCovering			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. All openings and penetrations are modelled to nominal dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Tile length/width	Size of the floor tiles.	numeric	mm
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m^2
	Net Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m^2
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is Water Resistent	Indicates whether the object is water resistant (TRUE) or not (FALSE).	boolean	YES/NO
	Has NonSkid Surface	Indication whether the surface finish is designed to prevent slippery (TRUE) or not (FALSE).	boolean	YES/NO
	Has AntiStatic Surface	Indication whether the surface finish is designed to prevent electrostatic charge (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Floor" / IfcCovering			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations, openings and connections modelled to rough dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Tile length/width	Size of the floor tiles.	numeric	mm
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m^2
	Net Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m^2
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values).	numeric	/
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is Water Resistent	Indicates whether the object is water resistant (TRUE) or not (FALSE).	boolean	YES/NO
	Has NonSkid Surface	Indication whether the surface finish is designed to prevent slippery (TRUE) or not (FALSE).	boolean	YES/NO
	Has AntiStatic Surface	Indication whether the surface finish is designed to prevent electrostatic charge (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Ceiling" / IfcCovering			
Geometrical Information:				
Detail:	Simplified volume representation modelled to the overall thickness. Major openings modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	BuildingStorey	Defines the reference building storey.	text	/
	Elevation	Specifies the elevation of the element.	numeric	m
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Finish	The type of finish for the ceiling.	text	/
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m²
	Performance Data			
	Is False Ceiling	Indicates whether the ceiling is false (TRUE) or not (FALSE).	boolean	YES/NO
	Cost			
	Estimated Unit Cost	Estimated cost of element per m² / m³ . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Ceiling" / IfcCovering			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. Openings modelled to nominal dimensions. Location of control joints indicated, but not modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Tile length/width	Size of the ceiling tiles.	numeric	mm
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m²
	Net Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m²
	Performance Data			
	Is False Ceiling	Indicates whether the ceiling is false (TRUE) or not (FALSE).	boolean	YES/NO
	Is Water Resistent	Indicates whether the object is water resistent (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Ceiling" / IfcCovering			
Geometrical Information:				
Detail:	specific width.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Tile length/width	Size of the ceiling tiles.	numeric	mm
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Gross Area	Sum of all gross areas of the covering facing the space. No opening that is included in the covering is subtracted.	numeric	m²
	Net Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m²
	Performance Data			
	Is False Ceiling	Indicates whether the ceiling is false (TRUE) or not (FALSE).	boolean	YES/NO
	Is Water Resistent	Indicates whether the object is water resistent (TRUE) or not (FALSE).	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values).	numeric	/
	Is Water Resistent	Indicates whether the object is water resistant (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Door" / IfcDoor			
Geometrical information:				
Detail:	Simplified volume representation. Modelled with simple frame and panel.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	BuildingStorey	Defines the reference building storey.	text	/
	OpeningDirection	Defines whether the door swings inside or away of the room.	text	/
	Material			
	Panel Material	The primary material used to construct the panel.	text	/
	Panel Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Height	Total outer heigth of the door lining.	numeric	mm
	Width	Total outer width of the door lining.	numeric	mm
	Area	Total area of the outer lining of the door.	numeric	m^2
	OpeningWidth	Width of the wall opening.	numeric	mm
	OpeningHeight	Height of the wall opening.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit door in accordance to the national building code.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety code or regulation.	numeric	/
	Self Closing	Indication whether this object is designed to close automatically after use (TRUE) or not (FALSE).	boolean	YES/NO
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Door" / IfcDoor			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Major framing elements are modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	BuildingStorey	Defines the reference building storey.	text	/
	OpeningDirection	Defines whether the door swings inside or away of the room.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Panel Material	The primary material used to construct the panel.	text	/
	Frame Material	The primary material used to construct the frame.	text	/
	Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Panel Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Dimensional Data			
	Sill Height	The distance from the top of the floor level to the bottom side of the object.	numeric	mm
	Height	Total outer heigth of the door lining.	numeric	mm
	Width	Total outer width of the door lining.	numeric	mm
	Area	Total area of the outer lining of the door.	numeric	m^2
	OpeningWidth	Width of the wall opening.	numeric	mm
	OpeningHeight	Height of the wall opening.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit door in accordance to the national building code.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety code or regulation.	numeric	/
	Has Treshold	Indication whether this object has a treshold (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Grille	Indication whether this object has a grille (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Antitheft System	Indication whether this object has antitheft system (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Access Control	Indication whether this object is designed to prevent unathorized access (TRUE) or not (FALSE). .	boolean	YES/NO
	Self Closing	Indication whether this object is designed to close automatically after use (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Door" / IfcDoor			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Major framing elements and connections are modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	BuildingStorey	Defines the reference building storey.	text	/
	OpeningDirection	Defines whether the door swings inside or away of the room.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Material			
	Panel Material	The primary material used to construct the panel.	text	/
	Frame Material	The primary material used to construct the frame.	text	/
	Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Panel Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Dimensional Data			
	Sill Height	The distance from the top of the floor level to the bottom side of the object.	numeric	mm
	Height	Total outer heigth of the door lining.	numeric	mm
	Width	Total outer width of the door lining.	numeric	mm
	Area	Total area of the outer lining of the door.	numeric	m^2
	OpeningWidth	Width of the wall opening.	numeric	mm
	OpeningHeight	Height of the wall opening.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit door in accordance to the national building code.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety code or regulation.	numeric	/
	Has Treshold	Indication whether this object has a treshold (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Grille	Indication whether this object has a grille (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Antitheft System	Indication whether this object has antitheft system (TRUE) or not (FALSE). .	boolean	YES/NO
	Has Access Control	Indication whether this object is designed to prevent unathorized access (TRUE) or not (FALSE). .	boolean	YES/NO
	Self Closing	Indication whether this object is designed to close automatically after use (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Window" / IfcWindow			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled with simplified frame and glazing.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	BuildingStorey	Defines the reference building storey.	text	/
	OpeningType	Defines whether the window swings inside or away of the room.	text	/
		Material		
	Frame Material	The primary material used to construct the frame.	text	/
	External Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Internal Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
		Dimensional Data		
	Sill Height	The distance from the top of the floor level to the bottom side of the object.	numeric	mm
	Height	Total outer height of the window lining.		mm
	Width	Total outer width of the window lining.	numeric	mm
	Opening Height	Height of the wall opening.	numeric	mm
	Opening Width	Width of the wall opening.	numeric	mm
	Area	Total area of the outer lining of the window.	numeric	m²
		Performance Data		
	Has Sill External	Indication whether the window opening has an external sill (TRUE) or not (FALSE).	boolean	YES/NO
	Has Sill Internal	Indication whether the window opening has an internal sill (TRUE) or not (FALSE).	boolean	YES/NO
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
		Cost		
	Estimated Unit Cost	Estimated cost of element per m² / m³. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Window" / IfcWindow			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions and geometry. Major framing elements and glazing are modelled precisely.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Building Storey	Defines the reference building storey.	text	/
	OpeningType	Defines whether the window swings inside or away of the room.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Frame Material	The primary material used to construct the frame.	text	/
	External Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Internal Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Sill Material	The primary material used to construct the sill.	text	/
	Stool Material	The primary material used to construct the stool.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Glass Colour	Color (tint) selection for this glazing. It is given for information purposes only.	text	/
		Dimensional Data		
	Sill Height	The distance from the top of the floor level to the bottom side of the object.	numeric	mm
	Height	Total outer height of the window lining.		mm
	Width	Total outer width of the window lining.	numeric	mm
	Opening Height	Height of the wall opening.	numeric	mm
	Opening Width	Width of the wall opening.	numeric	mm
	Glass Thickness	Width of glass panel, measured from inside of the panel to the outside i.e. parallel to the window (elevation) plane.	numeric	mm
	Frame Thickness	Width of panel frame, measured from inside of panel (at glazing) to outside of panel (at lining), i.e. parallel to the window (elevation) plane.	numeric	mm
	Area	Total area of the outer lining of the window.	numeric	m²
		Performance Data		
	Has Sill External	Indication whether the window opening has an external sill (TRUE) or not (FALSE).	boolean	YES/NO
	Has Sill Internal	Indication whether the window opening has an internal sill (TRUE) or not (FALSE).	boolean	YES/NO
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is Tempered	Indication whether the element is tempered (TRUE) or not (FALSE).	boolean	YES/NO
	Is Laminated	Indication whether the glass is layered with other materials (TRUE) or not (FALSE).	boolean	YES/NO
	Is Coated	Indication whether the glass is coated with a material (TRUE) or not (FALSE).	boolean	YES/NO
	Is Wired	Indication whether the glass includes a contained wire mesh to prevent break-in (TRUE) or not (FALSE).	boolean	YES/NO
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³, including workforce and equipment.	numeric	€/m², €/ m³
	Unit Cost	Cost of material per m² / m³.	numeric	€/m², €/ m³
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Geometrical Information:				
Detail:	Element modelled to accurate dimensions and geometry. Major framing elements, glazing and frame profiles are modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Building Storey	Defines the reference building storey.	text	/
	OpeningType	Defines whether the window swings inside or away of the room.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Frame Material	The primary material used to construct the frame.	text	/
	External Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Internal Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Sill Material	The primary material used to construct the sill.	text	/
	Stool Material	The primary material used to construct the stool.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Glass Colour	Color (tint) selection for this glazing. It is given for information purposes only.	text	/
		Dimensional Data		
	Sill Height	The distance from the top of the floor level to the bottom side of the object.	numeric	mm
	Height	Total outer height of the window lining.	numeric	mm
	Width	Total outer width of the window lining.	numeric	mm
	Opening Height	Height of the wall opening.	numeric	mm
	Opening Width	Width of the wall opening.	numeric	mm
	Glass Thickness	Width of glass panel, measured from inside of the panel to the outside i.e. parallel to the window (elevation) plane.	numeric	mm
	Frame Thickness	Width of panel frame, measured from inside of panel (at glazing) to outside of panel (at lining), i.e. parallel to the window (elevation) plane.	numeric	mm
	Area	Total area of the outer lining of the window.	numeric	m²
		Performance Data		
	Has Sill External	Indication whether the window opening has an external sill (TRUE) or not (FALSE).	boolean	YES/NO
	Has Sill Internal	Indication whether the window opening has an internal sill (TRUE) or not (FALSE).	boolean	YES/NO
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is Tempered	Indication whether the element is tempered (TRUE) or not (FALSE).	boolean	YES/NO
	Is Laminated	Indication whether the glass is layered with other materials (TRUE) or not (FALSE).	boolean	YES/NO
	Is Coated	Indication whether the glass is coated with a material (TRUE) or not (FALSE).	boolean	YES/NO
	Is Wired	Indication whether the glass includes a contained wire mesh to prevent break-in (TRUE) or not (FALSE).	boolean	YES/NO
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³, including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³.	numeric	€/m², €/ m³
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Roof" / IfcRoof			
Geometrical information:				
Detail:	Simplified volume representation. Layers modelled as generic assembly.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Thickness	Nominal thickness (or height) of roof layers measured perpendicular to the roof plane.	numeric	mm
	Thermal LayerThickness	Nominal thickness (or height) of the thermal layer measured perpendicular to the roof plane.	numeric	mm
	Slope	Angle between roof surface and horizontal plane.	numeric	degrees
	Gross Area	Total gross area of the outer surface of the roof. It is the sum of all roof slab gross areas. Roof openings, like sky windows and other openings and cut-outs are not taken into account.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is UV Resistent	Indication whether the element is resistent to ultra violet rays / sunlight (TRUE) or not (FALSE).	boolean	YES/NO
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Roof" / IfcRoof			
Geometrical information:				
Detail:	Element modelled to accurate thickness and geometry. Penetrations and openings are modelled to nominal dimensions. Sloping surfaces modelled to actual dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Thickness	Nominal thickness (or height) of roof layers measured perpendicular to the roof plane.	numeric	mm
	Thermal LayerThickness	Nominal thickness (or height) of the thermal layer measured perpendicular to the roof plane.	numeric	mm
	Slope	Angle between roof surface and horizontal plane.	numeric	degrees
	Gross Area	Total gross area of the outer surface of the roof. It is the sum of all roof slab gross areas. Roof openings, like sky windows and other openings and cut-outs are not taken into account.	numeric	m^2
	Net Area	Total net area of the outer surface of the roof. It is the sum of all roof slab net areas. Roof openings, like sky windows and other openings and cut-outs are taken into account.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is UV Resistent	Indication whether the element is resistent to ultra violet rays / sunlight (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Roof" / IfcRoof			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations modelled to rough-opening dimensions. Framing modelled as separate assembly.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Thickness	Nominal thickness (or height) of roof layers measured perpendicular to the roof plane.	numeric	mm
	Thermal LayerThickness	Nominal thickness (or height) of the thermal layer measured perpendicular to the roof plane.	numeric	mm
	Slope	Angle between roof surface and horizontal plane.	numeric	degrees
	Gross Area	Total gross area of the outer surface of the roof. It is the sum of all roof slab gross areas. Roof openings, like sky windows and other openings and cut-outs are not taken into account.	numeric	m^2
	Net Area	Total net area of the outer surface of the roof. It is the sum of all roof slab net areas. Roof openings, like sky windows and other openings and cut-outs are taken into account.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Is UV Resistent	Indication whether the element is resistent to ultra violet rays / sunlight (TRUE) or not (FALSE).	boolean	YES/NO
	Acoustic Rating	Acoustic rating for this object. It is provided according to the national building code. It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorption values).	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3, including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3.	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Archiectural

Information Delivery Milestone:	Design			
Purpose:	Architecture			
Actor:				
Object:	"Stairs" / IfcStairs			
Geometrical information:				
Detail:	Generic model representation with simplified treads and risers. Model containing nominal vertical and plan dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Number of Riser	Total number of the risers included in the stair.	numeric	/
	Number of Treads	Total number of treads included in the stair.	numeric	/
	Riser Height	Vertical distance from tread to tread. The riser height is supposed to be equal for all steps of a stair or stair flight.	numeric	mm
	Tread Length	Horizontal distance from the front of the thread to the front of the next tread. The tread length is supposed to be equal for all steps of the stair or stair flight at the walking line.	numeric	mm
	Length (Flight)	Total length of the stair flight along the walking line.	numeric	m
	Gross Volume (Flight)	Total gross volume of the stair flight. Openings, recesses, and projections are not taken into account.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit stair in accordance to the national building code..	boolean	YES/NO
	LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	numeric	/
	Has Non Skid Surface	Indication whether the surface finish is designed to prevent slippery (TRUE) or not (FALSE).	boolean	YES/NO
	Cost			
	Estimated Unit Cost	Estimated cost of element per m² / m³. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Architecture			
Actor:				
Object:	"Stairs" / IfcStairs			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Stair support elements modelled. Accurate presentation of handrails.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Number of Riser	Total number of the risers included in the stair.	numeric	/
	Number of Treads	Total number of treads included in the stair.	numeric	/
	Riser Height	Vertical distance from tread to tread. The riser height is supposed to be equal for all steps of a stair or stair flight.	numeric	mm
	Tread Length	Horizontal distance from the front of the thread to the front of the next tread. The tread length is supposed to be equal for all steps of the stair or stair flight at the walking line.	numeric	mm
	Length (Flight)	Total length of the stair flight along the walking line.	numeric	m
	Gross Volume (Flight)	Total gross volume of the stair flight. Openings, recesses, and projections are not taken into account.	numeric	m³
	Net Volume (Flight)	Total net volume of the stair flight. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit stair in accordance to the national building code..	boolean	YES/NO
	LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	numeric	/
	Has Non Skid Surface	Indication whether the surface finish is designed to prevent slippery (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Architecture			
Actor:				
Object:	"Stairs" / IfcStairs			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Stair support elements modelled. Accurate presentation of handrails.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Number of Riser	Total number of the risers included in the stair.	numeric	/
	Number of Treads	Total number of treads included in the stair.	numeric	/
	Riser Height	Vertical distance from tread to tread. The riser height is supposed to be equal for all steps of a stair or stair flight.	numeric	mm
	Tread Length	Horizontal distance from the front of the thread to the front of the next tread. The tread length is supposed to be equal for all steps of the stair or stair flight at the walking line.	numeric	mm
	Length (Flight)	Total length of the stair flight along the walking line.	numeric	m
	Gross Volume (Flight)	Total gross volume of the stair flight. Openings, recesses, and projections are not taken into account.	numeric	m³
	Net Volume (Flight)	Total net volume of the stair flight. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Fire Exit	Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). Here it defines an exit stair in accordance to the national building code..	boolean	YES/NO
	LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	numeric	/
	Has Non Skid Surface	Indication whether the surface finish is designed to prevent slippery (TRUE) or not (FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Structural

Information Delivery Milestone:	Design			
Purpose:	Structural			
Actor:				
Object:	"Structural Wall" / IfcWall			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	m
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path. It should only be provided, if it is constant along the wall path.	numeric	m
	Height	Total nominal height of the wall.	numeric	m
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m^3
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Structural Data			
	*If Concrete Estimated Reinforcement quantity	Estimated quantity of reinforcement for the unit.	numeric	kg
	*If Concrete Estimated Reinforcement weight per unit of volume	Estimated weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Structural			
Actor:				
Object:	"Structural Wall" / IfcWall			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. Penetrations are modelled to nominal dimensions for major wall openings and large mechanical elements.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	m
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path. It should only be provided, if it is constant along the wall path.	numeric	m
	Height	Total nominal height of the wall.	numeric	m
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m^2
	Net Volume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m^3
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m^3
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast /Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Structural			
Actor:				
Object:	"Structural Wall" / IfcWall			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to rough-opening dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line (even if different to the wall path).	numeric	m
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path. It should only be provided, if it is constant along the wall path.	numeric	m
	Height	Total nominal height of the wall.	numeric	m
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m^2
	Net Volume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m^3
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m^3
	Performance Data			
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Structural

Information Delivery Milestone:	Design			
Purpose:	Structural			
Actor:				
Object:	"Column" / IfcColumn			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry, so that the collisions are avoided.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Length	Total length of the column not taking into account any cut-out's or other processing features.		
	Section Shape	Specifies the section shape of the column.	text	/
	Section Dimensions/Diametar	The nominal width / diameter of the column section.	numeric	mm
	*If Concrete/Precast Gross Volume	Total gross volume of the column, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Estimated Reinforcement quantity	Estimated quantity of reinforcement for the unit.	numeric	kg
	*If Concrete/Estimated Reinforcement weight per unit of volume	Estimated weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	Cost			
	Estimated Unit Cost	Estimated cost of element per m³ / m³ . It is based on the average amount of needed resources [including material, labor and equipment).	numeric	€/m³, €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Structural			
Actor:				
Object:	"Column" / IfcColumn			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Penetrations and connections are modelled to nominal dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	The type of finish for the steel column.	text	/
	Dimensional Data			
	Length	Total length of the column not taking into account any cut-out's or other processing features.	numeric	m
	Section Shape	Specifies the section shape of the column.	text	/
	Section Dimensions/Diametar	The nominal width / diameter of the column section.	numeric	mm
	*If Concrete/Precast/Net Volume	Total net volume of the column, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the column (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m²
	Weight	Total net weight of the column without add-on parts, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	kg
	*If Concrete/Precast/Gross Volume	Total gross volume of the column, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m²
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m / m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Structural			
Actor:				
Object:	"Column" / IfcColumn			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to actual dimensions. *Element may include reinforcing, anchors and other embedded objects.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	The type of finish for the steel column.	text	/
	Dimensional Data			
	Length	Total length of the column not taking into account any cut-out's or other processing features.	numeric	m
	Section Shape	Specifies the section shape of the column.	text	/
	Section Dimensions/Diametar	The nominal width / diameter of the column section.	numeric	mm
	*If Concrete/Precast/Net Volume	Total net volume of the column, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the column (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m²
	Weight	Total net weight of the column without add-on parts, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	kg
	*If Concrete/Precast/Gross Volume	Total gross volume of the column, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m²
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³ , including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m / m² / m³ .	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

REQUIREMENTSSpecificator - Structural

Information Delivery Milestone:	Design			
Purpose:	Structural			
Actor:				
Object:	"Beam" / IfcBeam			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry, so that the collisions are avoided.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	*If Steel/Section Dimensions	The nominal width / height of the beam section.	numeric	mm
	Length	Total length of the beam, not taking into account any cut-out's or other processing features.	numeric	m
	*If Concrete/PrecastHeight	The nominal height of the beam.	numeric	m
	*If Concrete/PrecastWidth	The nomina width of the beam.	numeric	m
	*If Concrete/Precast Gross Volume	Total gross volume of the beam, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Gross Surface Area	Total area of the beam, normally generated as perimeter * length + 2 * cross section area. It is the sum of OuterSurfaceArea + (2 x CrossSectionArea) and shall only be given, if the OuterSurfaceArea and CrossSectionArea cannot be established separately.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Estimated Reinforcement quantity	Estimated quantity of reinforcement for the unit.	numeric	kg
	*If Concrete/Estimated Reinforcement weight per unit of volume	Estimated weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^3 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^3, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phase			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Structural			
Actor:				
Object:	"Beam" / IfcBeam			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions and geometry. Penetrations and connections are modelled to nominal dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	The type of finish for the steel beam.	text	/
	Dimensional Data			
	*If Steel/Section Dimensions	The nominal width / height of the beam section.	numeric	mm
	Length	Total length of the beam, not taking into account any cut-out's or other processing features.	numeric	m
	*If Concrete/PrecastHeight	The nominal height of the beam.	numeric	m
	*If Concrete/PrecastWidth	The nomina width of the beam.	numeric	m
	*If Concrete/Precast Net Volume	Total net volume of the beam, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the beam (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m^2
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^3 / m^3 , including workforce and equipment.	numeric	€/m^3, €/ m^3
	Material Cost	Cost of material per m / m^3 / m^3 .	numeric	€/m^3, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Structural			
Actor:				
Object:	"Beam" / IfcBeam			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to actual dimensions. *Element may include reinforcing, anchors and other embedded objects.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	The type of finish for the steel beam.	text	/
	Dimensional Data			
	*If Steel/Section Dimensions	The nominal width / height of the beam section.	numeric	mm
	Length	Total length of the beam, not taking into account any cut-out's or other processing features.	numeric	m
	*If Concrete/PrecastHeight	The nominal height of the beam.	numeric	m
	*If Concrete/PrecastWidth	The nomina width of the beam.	numeric	m
	*If Concrete/Precast Net Volume	Total net volume of the beam, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the beam (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for the element. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m^2
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^3 / m^3 , including workforce and equipment.	numeric	€/m^3, €/ m^3
	Material Cost	Cost of material per m / m^3 / m^3 .	numeric	€/m^3, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Structural

Information Delivery Milestone:	Design			
Purpose:	Structural			
Actor:				
Object:	"Slab" / IfcSlab			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry, so that the collisions are avoided.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Gross Area	Total area of the extruded area of the slab. Openings, recesses, and projections are not taken into account.	numeric	m^2
	Gross Volume	Total gross volume of the slab. Openings, recesses, and projections are not taken into account.	numeric	m^3
	Tickness	The nominal overall thickness of the slab.	numeric	mm
	*If Precast/Topping Tickness	The nominal thickness of the topping.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Estimated Reinforcement quantity	Estimated quantity of reinforcement for the unit.	numeric	kg
	*If Concrete/Estimated Reinforcement weight per unit of volume	Estimated weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	Cost			
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Structural			
Actor:				
Object:	"Slab" / IfcSlab			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Penetrations and joints are modelled to nominal dimensions. Sloping surfaces included.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Net Area	Total area of the extruded area of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^2
	Net Volume	Total net volume of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^3
	Tickness	The nominal overall thickness of the slab.	numeric	mm
	*If Precast/Topping Tickness	The nominal thickness of the topping.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Span Direction			
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m / m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Structural			
Actor:				
Object:	"Slab" / IfcSlab			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All connections, openings and joints modelled to actual dimensions. *Element may include reinforcing and post tension elements.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Not requested			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Net Area	Total area of the extruded area of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^2
	Net Volume	Total net volume of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^3
	Tickness	The nominal overall thickness of the slab.	numeric	mm
	*If Precast/Topping Tickness	The nominal thickness of the topping.	numeric	mm
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Structural/LoadBearing	Indicates whether the object is intended to carry loads (TRUE) or not (FALSE).	boolean	YES/NO
	Fire Rating	Fire rating for this object. It is given according to the national fire safety classification.	numeric	/
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	*If Concrete/Strength Class	Classification of the concrete strength in accordance with the concrete design code which is applied in the project.	numeric	Mpa
	Span Direction			
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	*If Precast/Production Date	Production date (stripped from form).	date time	date
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m^2 / m^3 , including workforce and equipment.	numeric	€/m^2, €/ m^3
	Material Cost	Cost of material per m / m^2 / m^3 .	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - Structural

Information Delivery Milestone:	Design			
Purpose:	Structural			
Actor:				
Object:	"Foundation" / IfcFooting / IfcPile			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry, so that the collisions are avoided.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Width	Total nominal width (or thickness) of the footing. For strip footings it is measured perpendicular to the footing path (or longitudial axis). For other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Length	Length of the footing, not taking into account any cut-out's or other processing features. For strip footings it is measured along the path, for other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Height	Total nominal height of the footing.	numeric	m
	*If pile/Depth	Total length of the pile not taking into account any cut-out's or other processing features.	numeric	m
	*If pile/Diameter	Diameter of the cross section of the pile.	numeric	m
	Gross Surface Area	Total area of the footing, normally generated as perimeter * length + 2 * cross section area. It is the sum of OuterSurfaceArea + (2 x CrossSectionAreal and shall only be given, if the OuterSurfaceArea and CrossSectionArea cannot be established separately.	numeric	m²
	Gross Volume	Total gross volume of the footing, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Structural Data			
	*If Concrete/Estimated Reinforcement quantity	Estimated quantity of reinforcement for the unit.	numeric	kg
	*If Concrete/Estimated Reinforcement weight per unit of volume	Estimated weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	Cost			
	Estimated Unit Cost	Estimated cost of element per m² / m³. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Estimated Cost	Estimated total cost needed for installing, based on estimated unit cost.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Structural			
Actor:				
Object:	"Foundation" / IfcFooting / IfcPile			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Penetrations and joints are modelled to nominal dimensions. Sloping surfaces included.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Width	Total nominal width (or thickness) of the footing. For strip footings it is measured perpendicular to the footing path (or longitudial axis). For other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Length	Length of the footing, not taking into account any cut-out's or other processing features. For strip footings it is measured along the path, for other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Height	Total nominal height of the footing.	numeric	m
	*If pile/Depth	Total length of the pile not taking into account any cut-out's or other processing features.	numeric	m
	*If pile/Diameter	Diameter of the cross section of the pile.	numeric	m
	*If precast/Cap Height	Total nominal height of the cap.	numeric	m
	*If precast/Cap Length	Total nominal length of the cap.	numeric	m
	*If precast/Cap Width	Total nominal width of the cap.	numeric	m
	Gross Surface Area	Total area of the footing, normally generated as perimeter * length + 2 * cross section area. It is the sum of OuterSurfaceArea + (2 x CrossSectionArea) and shall only be given, if the OuterSurfaceArea and CrossSectionArea cannot be established separately.	numeric	m²
	Outer Surface Area	Total area of the extruded surfaces of the footing (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m²
	Net Volume	Total net volume of the footing, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m²
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³, including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³.	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Structural			
Actor:				
Object:	"Foundation" / IfcFooting / IfcPile			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations and joints modelled to actual dimensions. *Element may include reinforcing and post tension elements.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Width	Total nominal width (or thickness) of the footing. For strip footings it is measured perpendicular to the footing path (or longitudial axis). For other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Length	Length of the footing, not taking into account any cut-out's or other processing features. For strip footings it is measured along the path, for other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	m
	Height	Total nominal height of the footing.	numeric	m
	*If pile/Depth	Total length of the pile not taking into account any cut-out's or other processing features.	numeric	m
	*If pile/Diameter	Diameter of the cross section of the pile.	numeric	m
	*If precast/Cap Height	Total nominal height of the cap.	numeric	m
	*If precast/Cap Length	Total nominal length of the cap.	numeric	m
	*If precast/Cap Width	Total nominal width of the cap.	numeric	m
	Gross Surface Area	Total area of the footing, normally generated as perimeter * length + 2 * cross section area. It is the sum of OuterSurfaceArea + (2 x CrossSectionArea) and shall only be given, if the OuterSurfaceArea and CrossSectionArea cannot be established separately.	numeric	m²
	Outer Surface Area	Total area of the extruded surfaces of the footing (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m²
	Net Volume	Total net volume of the footing, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Loadbearing capacity	Maximum load that can be applied to the structure.	numeric	kg/m²
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing the element.	numeric	€
	Installation Cost	Cost of installing per m² / m³, including workforce and equipment.	numeric	€/m², €/ m³
	Material Cost	Cost of material per m² / m³.	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Duct" / IfcDuctSegment			
Geometrical Information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a syster.		
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Width	The nominal width of the duct segment.	numeric	mm
	Height	The nominal height of the duct segment.	numeric	mm
	Diameter	The nominal diameter of the duct segment.	numeric	mm
	Section Area	Area of the cross section, including the duct itself and the interior flow space	numeric	mm^2
	Performance Data			
	Has Exterior Insulation	TRUE if the duct has exterior insulation. FALSE if it does not.	bolean	YES/NO
	Weight	The weight of the unit.	numeric	kg
	Mechanical Data			
	Air Flow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Allowable minimum and maximum temperature.	numeric	°C
	Air Pressure	The pressure within a container due to the compression of atmospheric gases.	numeric	Pa
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Duct" / IfcDuctSegment			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a syster.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Level	Defines the reference level.	text	/
	Upper End Top Elevation	Defines the elevation at the top of the upper end.	numeric	m
	Lower End Bottom Elevation	Defines the elevation at the bottom of the lower end.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Width	The nominal width of the duct segment.	numeric	mm
	Height	The nominal height of the duct segment.	numeric	mm
	Diameter	The nominal diameter of the duct segment.	numeric	mm
	Section Area	Area of the cross section, including the duct itself and the interior flow space.	numeric	mm^2
	Performance Data			
	Has Exterior Insulation	TRUE if the duct has exterior insulation. FALSE if it does not.	bolean	YES/NO
	Weight	The weight of the unit.	numeric	kg
	Mechanical Data			
	Air Flow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Allowable minimum and maximum temperature.	numeric	°C
	Air Pressure	The pressure within a container due to the compression of atmospheric gases.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Duct" / IfcDuctSegment			
Geometrical Information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearancess modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a syster.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Level	Defines the reference level.	text	/
	Upper End Top Elevation	Defines the elevation at the top of the upper end.	numeric	m
	Lower End Bottom Elevation	Defines the elevation at the bottom of the lower end.	numeric	m
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Width	The nominal width of the duct segment.	numeric	mm
	Height	The nominal height of the duct segment.	numeric	mm
	Diameter	The nominal diameter of the duct segment.	numeric	mm
	Section Area	Area of the cross section, including the duct itself and the interior flow space.	numeric	mm^2
	Performance Data			
	Has Exterior Insulation	TRUE if the duct has exterior insulation. FALSE if it does not.	bolean	YES/NO
	Weight	The weight of the unit.	numeric	kg
	Mechanical Data			
	Air Flow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Allowable minimum and maximum temperature.	numeric	°C
	Air Pressure	The pressure within a container due to the compression of atmospheric gases.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	Warranty Description	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Air Terminal" / IfcAirTerminal			
Geometrical information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	The type of finish for the air terminal.	text	/
	Dimensional Data			
	Width	The nominal width of the air terminal.	numeric	m
	Height	The nominal height of the air terminal.	numeric	m
	DuctWidth	The nominal width of the duct.	numeric	m
	DuctHeight	The nominal height of the air terminal.	numeric	m
	Volume	The nominal width of the air terminal.	numeric	m^3
	Performance Data			
	Has Thermal Insulation	If TRUE, the air terminal has thermal insulation.	boolean	YES/NO
	Has Sound Attenuator	If TRUE, the air terminal has sound attenuation.	boolean	YES/NO
	Has Integral Control	If TRUE, a self powered temperature control is included in the AirTerminal.	boolean	YES/NO
	Mechanical Data			
	AirFlow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	AirFlow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Temperature range within which the air terminal is designed to operate.	numeric	°C
	Neck Area	Neck area of the air terminal.	numeric	mm^2
	Throw Length	The horizontal or vertical axial distance an airstream travels after leaving an Air Terminal before the maximum stream velocity is reduced to a specified terminal velocity under isothermal conditions at the upper value of the Air Flow rate Range.	numeric	mm
	Maximum Sound Level	The average maximum noise level.	numeric	dB
	Pressure Drop	Drop in total pressure between inlet and outlet at nominal air flow rate.	numeric	
	Airflow Type	Enumeration defining the functional type of air flow through the terminal.	text	/
	Installation Data			
	Mounting Type	The way the air terminal is mounted to the ceiling, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Air Terminal" / IfcAirTerminal			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Elevation from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	The type of finish for the air terminal.	text	/
	Dimensional Data			
	Width	The nominal width of the air terminal.	numeric	mm
	Height	The nominal height of the air terminal.	numeric	mm
	DuctWidth	The nominal width of the duct.	numeric	mm
	DuctHeight	The nominal height of the air terminal.	numeric	mm
	Volume	The nominal width of the air terminal.	numeric	m^3
	Performance Data			
	Has Thermal Insulation	If TRUE, the air terminal has thermal insulation.	boolean	YES/NO
	Has Sound Attenuator	If TRUE, the air terminal has sound attenuation.	boolean	YES/NO
	Has Integral Control	If TRUE, a self powered temperature control is included in the AirTerminal.	boolean	YES/NO
	Mechanical Data			
	AirFlow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	AirFlow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Temperature range within which the air terminal is designed to operate.	numeric	°C
	Neck Area	Neck area of the air terminal.	numeric	mm^2
	Throw Length	The horizontal or vertical axial distance an airstream travels after leaving an Air Terminal before the maximum stream velocity is reduced to a specified terminal velocity under isothermal conditions at the upper value of the Air Flow rate Range.	numeric	mm
	Maximum Sound Level	The average maximum noise level.	numeric	dB
	Pressure Drop	Drop in total pressure between inlet and outlet at nominal air flow rate.	numeric	
	Airflow Type	Enumeration defining the functional type of air flow through the terminal.	text	/
	Installation Data			
	Mounting Type	The way the air terminal is mounted to the ceiling, wall, etc.	text	/
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Air Terminal" / IfcAirTerminal			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual size for all supports and clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Elevation from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	The type of finish for the air terminal.	text	/
	Dimensional Data			
	Width	The nominal width of the air terminal.	numeric	mm
	Height	The nominal height of the air terminal.	numeric	mm
	DuctWidth	The nominal width of the duct.	numeric	mm
	DuctHeight	The nominal height of the air terminal.	numeric	mm
	Volume	The nominal width of the air terminal.	numeric	m^3
	Performance Data			
	Has Thermal Insulation	If TRUE, the air terminal has thermal insulation.	boolean	YES/NO
	Has Sound Attenuator	If TRUE, the air terminal has sound attenuation.	boolean	YES/NO
	Has Integral Control	If TRUE, a self powered temperature control is included in the AirTerminal.	boolean	YES/NO
	Mechanical Data			
	AirFlow Rate Range	Air flowrate range within which the air terminal is designed to operate.	numeric	Liter/Minute
	AirFlow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Temperature Range	Temperature range within which the air terminal is designed to operate.	numeric	°C
	Neck Area	Neck area of the air terminal.	numeric	mm^2
	Throw Length	The horizontal or vertical axial distance an airstream travels after leaving an Air Terminal before the maximum stream velocity is reduced to a specified terminal velocity under isothermal conditions at the upper value of the Air Flow rate Range.	numeric	mm
	Maximum Sound Level	The average maximum noise level.	numeric	dB
	Pressure Drop	Drop in total pressure between inlet and outlet at nominal air flow rate.	numeric	
	Airflow Type	Enumeration defining the functional type of air flow through the terminal.	text	/
	Installation Data			
	Mounting Type	The way the air terminal is mounted to the ceiling, wall, etc.	text	/
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Coil" / IfcCoil			
Geometrical information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.		
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the coil.	numeric	mm
	Width	The nominal width of the coil.	numeric	mm
	Height	The nominal height of the coil.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Air Pressure Drop	Reduction in air pressure / Pressure loss.	numeric	Pa
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Coil" / IfcCoil			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the coil.	numeric	mm
	Width	The nominal width of the coil.	numeric	mm
	Height	The nominal height of the coil.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Heat Transfer Coefficient	The heat transfer coefficient expresses the amount of heat transferred between a fluid (either a liquid or gas) and a solid surface by convection.	numeric	W/m^2 °C
	Air Pressure Drop	Reduction in air pressure / Pressure loss.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Coil" / IfcCoil			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearances modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the coil.	numeric	mm
	Width	The nominal width of the coil.	numeric	mm
	Height	The nominal height of the coil.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Heat Transfer Coefficient	The heat transfer coefficient expresses the amount of heat transferred between a fluid (either a liquid or gas) and a solid surface by convection.	numeric	W/m^2 °C
	Air Pressure Drop	Reduction in air pressure / Pressure loss.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	Warranty Description	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Fan" / IfcFan			
Geometrical Information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the fan.	numeric	mm
	Width	The nominal width of the fan.	numeric	mm
	Height	The nominal height of the fan.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Operation Temperature Range	Allowable operation ambient air temperature range.	numeric	°C
	Operational Criteria	Time of operation at maximum operational ambient air temperature.	numeric	hour
	Discharge Pressure Loss	Fan discharge pressure loss associated with the discharge arrangement.	numeric	Pa
	Discharge Velocity	The speed at which air discharges from the fan through the fan housing discharge opening.	numeric	m/s
	Fan Power Rate	Fan power consumption.	numeric	W
	Fan Efficiency	Fan mechanical efficiency.	numeric	%
	Motor Drive Type	Motor drive type e.g., DIRECT DRIVE: Direct drive.	text	/
	Nominal Power Rate	Nominal fan power rate.	numeric	W
	Nominal Total Pressure	Nominal total pressure rise across the fan.	numeric	Pa
	Overall Efficiency	Total efficiency of motor and fan.	numeric	%
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^3 / m^2. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^3, €/ m^2
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Fan" / IfcFan			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the fan.	numeric	mm
	Width	The nominal width of the fan.	numeric	mm
	Height	The nominal height of the fan.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Operation Temperature Range	Allowable operation ambient air temperature range.	numeric	°C
	Operational Criteria	Time of operation at maximum operational ambient air temperature.	numeric	hour
	Discharge Pressure Loss	Fan discharge pressure loss associated with the discharge arrangement.	numeric	Pa
	Discharge Velocity	The speed at which air discharges from the fan through the fan housing discharge opening.	numeric	m/s
	Fan Power Rate	Fan power consumption.	numeric	W
	Fan Efficiency	Fan mechanical efficiency.	numeric	%
	Motor Drive Type	Motor drive type e.g., DIRECT DRIVE: Direct drive.	text	/
	Nominal Power Rate	Nominal fan power rate.	numeric	W
	Nominal Total Pressure	Nominal total pressure rise across the fan.	numeric	Pa
	Overall Efficiency	Total efficiency of motor and fan.	numeric	%
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Fan" / IfcFan			
Geometrical Information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearances modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the fan.	numeric	mm
	Width	The nominal width of the fan.	numeric	mm
	Height	The nominal height of the fan.	numeric	mm
	Mechanical Data			
	Air Flow Rate Range	Possible range of airflow that can be delivered.	numeric	Liter/Minute
	Air Flow Rate	The actual airflow rate as designed.	numeric	Liter/Minute
	Operation Temperature Range	Allowable operation ambient air temperature range.	numeric	°C
	Operational Criteria	Time of operation at maximum operational ambient air temperature.	numeric	hour
	Discharge Pressure Loss	Fan discharge pressure loss associated with the discharge arrangement.	numeric	Pa
	Discharge Velocity	The speed at which air discharges from the fan through the fan housing discharge opening.	numeric	m/s
	Fan Power Rate	Fan power consumption.	numeric	W
	Fan Efficiency	Fan mechanical efficiency.	numeric	%
	Motor Drive Type	Motor drive type e.g., DIRECT DRIVE: Direct drive.	text	/
	Nominal Power Rate	Nominal fan power rate.	numeric	W
	Nominal Total Pressure	Nominal total pressure rise across the fan.	numeric	Pa
	Overall Efficiency	Total efficiency of motor and fan.	numeric	%
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Chiller" / IfcChiller			
Geometrical Information:				
Detail:	Element modelled as simplified volume representation with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the chiller.	numeric	mm
	Width	The nominal width of the chiller.	numeric	mm
	Height	The nominal height of the chiller.	numeric	mm
	Mechanical Data			
	Capacity	The product of the ideal capacity and the overall volumetric efficiency of the compressor.	numeric	w
	Nominal Efficiency	Nominal chiller efficiency under nominal conditions.	numeric	%
	Nominal Capacity	Nominal cooling capacity of chiller at standardized conditions as defined by the agency having jurisdiction.	numeric	W
	Cooling Water Pressure Drop	The pressure difference of the cooling water.	numeric	Pa
	Cooling Water Flow	Nominal water flow.	numeric	L/s
	Cooling Capacity	Cooling capacity measures the ability of a cooling system to remove heat.	numeric	W
	Chilled Water Pressure Drop	The pressure difference of the chilled water.	numeric	Pa
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Chiller" / IfcChiller			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the chiller.	numeric	mm
	Width	The nominal width of the chiller.	numeric	mm
	Height	The nominal height of the chiller.	numeric	mm
	Mechanical Data			
	Capacity	The product of the ideal capacity and the overall volumetric efficiency of the compressor.	numeric	w
	Nominal Efficiency	Nominal chiller efficiency under nominal conditions.	numeric	%
	Nominal Capacity	Nominal cooling capacity of chiller at standardized conditions as defined by the agency having jurisdiction.	numeric	W
	Cooling Water Pressure Drop	The pressure difference of the cooling water.	numeric	Pa
	Cooling Water Flow	Nominal water flow.	numeric	L/s
	Cooling Capacity	Cooling capacity measures the ability of a cooling system to remove heat.	numeric	W
	Chilled Water Pressure Drop	The pressure difference of the chilled water.	numeric	Pa
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Number of Poles	The number of live lines that is intended to be handled by the device.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Chiller" / IfcChiller			
Geometrical Information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual size for all supports and clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the chiller.	numeric	mm
	Width	The nominal width of the chiller.	numeric	mm
	Height	The nominal height of the chiller.	numeric	mm
	Mechanical Data			
	Capacity	The product of the ideal capacity and the overall volumetric efficiency of the compressor.	numeric	w
	Nominal Efficiency	Nominal chiller efficiency under nominal conditions.	numeric	%
	Nominal Capacity	Nominal cooling capacity of chiller at standardized conditions as defined by the agency having jurisdiction.	numeric	W
	Cooling Water Pressure Drop	The pressure difference of the cooling water.	numeric	Pa
	Cooling Water Flow	Nominal water flow.	numeric	L/s
	Cooling Capacity	Cooling capacity measures the ability of a cooling system to remove heat.	numeric	W
	Chilled Water Pressure Drop	The pressure difference of the chilled water.	numeric	Pa
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Number of Poles	The number of live lines that is intended to be handled by the device.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Boiler" / IfcBoiler			
Geometrical Information:				
Detail:	Element modelled as simplified volume representation with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the boiler.	numeric	mm
	Width	The nominal width of the boiler.	numeric	mm
	Diameter of exhaust connection	The nominal diameter of the exhaust connection.	numeric	mm
	Height	The nominal height of the boiler.	numeric	mm
	Performance Data			
	Is Water Storage Heater	This is used to identify if the boiler has storage capacity (TRUE). If FALSE, then there is no storage capacity built into the boiler, such as an instantaneous hot water heater.	bolean	YES/NO
	Mechanical Data			
	Water Storage Capacity	Water storage capacity.	numeric	litres
	Heat Output	Total nominal heat output as listed by the Boiler manufacturer. *For steam boilers, it is a function of inlet temperature versus steam pressure.	numeric	BTU/Hr
	Energy Source	Enumeration defining the energy source or fuel cumbusted to generate heat.	text	/
	Outlet Temperature Range	Allowable outlet temperature of either the water or the steam.	numeric	°C
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Boiler" / IfcBoiler			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the boiler.	numeric	mm
	Width	The nominal width of the boiler.	numeric	mm
	Diameter of exhaust connection	The nominal diameter of the exhaust connection.	numeric	mm
	Height	The nominal height of the boiler.	numeric	mm
	Performance Data			
	Is Water Storage Heater	This is used to identify if the boiler has storage capacity (TRUE). If FALSE, then there is no storage capacity built into the boiler, such as an instantaneous hot water heater.	bolean	YES/NO
	Mechanical Data			
	Water Storage Capacity	Water storage capacity.	numeric	litres
	Nominal Energy Consumption	Nominal fuel consumption rate required to produce the total boiler heat output.	numeric	BTU
	Water Inlet Temperature Range	Allowable water inlet temperature range.	numeric	°C
	Working Pressure	Boiler working pressure.	numeric	Pa
	*If steam/Maximum Outlet Pressure	Maximum steam outlet pressure.	numeric	Pa
	Heat Output	Total nominal heat output as listed by the Boiler manufacturer. *For steam boilers, it is a function of inlet temperature versus steam pressure.	numeric	BTU/Hr
	Nominal Efficiency	The nominal efficiency of the boiler as defined by the manufacturer. *For steam boilers, a function of inlet temperature versus steam pressure. *For water boilers, a function of inlet versus outlet temperature.	numeric	%
	Energy Source	Enumeration defining the energy source or fuel cumbusted to generate heat.	text	/
	Operating Mode	Identifies the operating mode of the boiler e.g., FIXED.	text	/
	Outlet Temperature Range	Allowable outlet temperature of either the water or the steam.	numeric	°C
	Combustion Efficiency	Combustion efficiency under nominal condition.	numeric	%
	Gass released	Type of gass released.	text	/
	Gass Flow Rate	Nominal gass flow.	numeric	l/s
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Boiler" / IfcBoiler			
Geometrical Information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual size for all supports and clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the boiler.	numeric	mm
	Width	The nominal width of the boiler.	numeric	mm
	Diameter of exhaust connection	The nominal diameter of the exhaust connection.	numeric	mm
	Height	The nominal height of the boiler.	numeric	mm
	Performance Data			
	Is Water Storage Heater	This is used to identify if the boiler has storage capacity (TRUE). If FALSE, then there is no storage capacity built into the boiler, such as an instantaneous hot water heater.	bolean	YES/NO
	Performance Data			
	Water Storage Capacity	Water storage capacity.	numeric	litres
	Nominal Energy Consumption	Nominal fuel consumption rate required to produce the total boiler heat output.	numeric	BTU
	Water Inlet Temperature Range	Allowable water inlet temperature range.	numeric	°C
	Working Pressure	Boiler working pressure.	numeric	Pa
	*If steam/Maximum Outlet Pressure	Maximum steam outlet pressure.	numeric	Pa
	Heat Output	Total nominal heat output as listed by the Boiler manufacturer. *For steam boilers, it is a function of inlet temperature versus steam pressure.	numeric	BTU/Hr
	Nominal Efficiency	The nominal efficiency of the boiler as defined by the manufacturer. *For steam boilers, a function of inlet temperature versus steam pressure. *For water boilers, a function of inlet versus outlet temperature.	numeric	%
	Energy Source	Enumeration defining the energy source or fuel cumbusted to generate heat.	text	/
	Operating Mode	Identifies the operating mode of the boiler e.g., FIXED.	text	/
	Outlet Temperature Range	Allowable outlet temperature of either the water or the steam.	numeric	°C
	Combustion Efficiency	Combustion efficiency under nominal condition.	numeric	%
	Gass released	Type of gass released.	text	/
	Gass Flow Rate	Nominal gass flow.	numeric	l/s
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Mechanical			
Actor:				
Object:	"Air Conditioning" / IfcUnitaryEquipment			
Geometrical information:				
Detail:	Element modelled as simplified volume representation with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the air conditioning unit.	numeric	mm
	Width	The nominal width of the air conditioning unit.	numeric	mm
	Height	The nominal height of the air conditioning unit.	numeric	mm
	Mechanical Data			
	Heating Capacity	Heating capacity.	numeric	BTU/Hr
	Cooling Capacity	Cooling capacity.	numeric	BTU/Hr
	Condenser Flowrate	Flow rate of fluid through the condenser.	numeric	liter/mn
	Outside Air Flowrate	Flow rate of outside air entering the unit.	numeric	liter/mn
	Heating Efficiency	Heating efficiency under full load heating conditions.	numeric	/
	Cooling Efficiency	Coefficient of Performance: Ratio of cooling energy output to energy input under full load operating conditions.	numeric	/
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Mechanical			
Actor:				
Object:	"Air Conditioning" / IfcUnitaryEquipment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the air conditioning unit.	numeric	mm
	Width	The nominal width of the air conditioning unit.	numeric	mm
	Height	The nominal height of the air conditioning unit.	numeric	mm
	Mechanical Data			
	Heating Capacity	Heating capacity.	numeric	BTU/Hr
	Cooling Capacity	Cooling capacity.	numeric	BTU/Hr
	Condenser Flowrate	Flow rate of fluid through the condenser.	numeric	liter/min
	Outside Air Flowrate	Flow rate of outside air entering the unit.	numeric	liter/min
	Heating Efficiency	Heating efficiency under full load heating conditions.	numeric	/
	Cooling Efficiency	Coefficient of Performance: Ratio of cooling energy output to energy input under full load operating conditions.	numeric	/
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Mechanical			
Actor:				
Object:	"Air Conditioning" / IfcUnitaryEquipment			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual size for all supports and clearancess modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	The nominal length of the air conditioning unit.	numeric	mm
	Width	The nominal width of the air conditioning unit.	numeric	mm
	Height	The nominal height of the air conditioning unit.	numeric	mm
	Mechanical Data			
	Heating Capacity	Heating capacity.	numeric	BTU/Hr
	Cooling Capacity	Cooling capacity.	numeric	BTU/Hr
	Condenser Flowrate	Flow rate of fluid through the condenser.	numeric	liter/min
	Outside Air Flowrate	Flow rate of outside air entering the unit.	numeric	liter/min
	Heating Efficiency	Heating efficiency under full load heating conditions.	numeric	/
	Cooling Efficiency	Coefficient of Performance: Ratio of cooling energy output to energy input under full load operating conditions.	numeric	/
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Piping" / IfcPipeSegment			
Geometrical information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Diameter	The nominal diameter of the pipe segment.	numeric	mm
	Slope	Angle of the pipe.	numeric	degrees
	Performance Data			
	Has Insulation	If TRUE, the pipe has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Working Pressure	Working pressure.	numeric	Pa
	Pressure Range	Allowable maximum and minimum working pressure (relative to ambient pressure).	numeric	Pa
	Temperature Range	Allowable maximum and minimum temperature.	numeric	°C
	Flow	Flow rate for the pipe.	numeric	l/min
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Piping" / IfcPipeSegment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Diameter	The nominal diameter of the pipe segment.	numeric	mm
	Slope	Angle of the pipe.	numeric	degrees
	Performance Data			
	Has Insulation	If TRUE, the pipe has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Working Pressure	Working pressure.	numeric	Pa
	Pressure Range	Allowable maximum and minimum working pressure (relative to ambient pressure).	numeric	Pa
	Temperature Range	Allowable maximum and minimum temperature.	numeric	°C
	Flow	Flow rate for the pipe.	numeric	l/min
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Piping" / IfcPipeSegment			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearancess modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Diameter	The nominal diameter of the pipe segment.	numeric	mm
	Slope	Angle of the pipe.	numeric	degrees
	Performance Data			
	Has Insulation	If TRUE, the pipe has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Working Pressure	Working pressure.	numeric	Pa
	Pressure Range	Allowable maximum and minimum working pressure (relative to ambient pressure).	numeric	Pa
	Temperature Range	Allowable maximum and minimum temperature.	numeric	°C
	Flow	Flow rate for the pipe.	numeric	l/min
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Valve" / IfcValve			
Geometrical Information:				
Detail:	Element modelled in schematic layout with approximate size and shape. Approximate clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Valve Material	Material from which the body of the valve is constructed.	text	/
	Pipe Material	Material from which the pipe is constructed.	text	/
	Dimensional Data			
	Length	The nominal length of the valve.	numeric	mm
	Diametar	The nominal diameter of valve.	numeric	mm
	Size	The size of the connection to the valve (or to each connection for faucets, mixing valves, etc.).	numeric	mm
	Performance Data			
	Has Insulation	If TRUE, the valve has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Valve Mechanism	The mechanism by which the valve function is achieved e.g., BALL.	text	/
	Flow Coefficient	Flow coefficient (the quantity of fluid that passes through a fully open valve at unit pressure drop), typically expressed as the Kv or Cv value for the valve.	numeric	Kv/Cv
	Working Pressure	The normally expected maximum working pressure of the valve.	numeric	Pa
	Measured Flow Rate	The rate of flow of a fluid measured across the valve.	numeric	l/min
	Measured Pressure Drop	The actual pressure drop in the fluid measured across the valve.	numeric	Pa
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Valve" / IfcValve			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Valve Material	Material from which the body of the valve is constructed.	text	/
	Pipe Material	Material from which the pipe is constructed.	text	/
	Dimensional Data			
	Length	The nominal length of the valve.	numeric	mm
	Diametar	The nominal diameter of valve.	numeric	mm
	Size	The size of the connection to the valve (or to each connection for faucets, mixing valves, etc.).	numeric	mm
	Performance Data			
	Has Insulation	If TRUE, the valve has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Valve Mechanism	The mechanism by which the valve function is achieved e.g., BALL.	text	/
	Flow Coefficient	Flow coefficient (the quantity of fluid that passes through a fully open valve at unit pressure drop), typically expressed as the Kv or Cv value for the valve.	numeric	Kv/Cv
	Working Pressure	The normally expected maximum working pressure of the valve.	numeric	Pa
	Measured Flow Rate	The rate of flow of a fluid measured across the valve.	numeric	l/min
	Measured Pressure Drop	The actual pressure drop in the fluid measured across the valve.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Valve" / IfcValve			
Geometrical Information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearancess modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Valve Material	Material from which the body of the valve is constructed.	text	/
	Pipe Material	Material from which the pipe is constructed.	text	/
	Dimensional Data			
	Length	The nominal length of the valve.	numeric	mm
	Diametar	The nominal diameter of valve.	numeric	mm
	Size	The size of the connection to the valve (or to each connection for faucets, mixing valves, etc.).	numeric	mm
	Performance Data			
	Has Insulation	If TRUE, the valve has thermal insulation.	boolean	YES/NO
	Mechanical Data			
	Valve Mechanism	The mechanism by which the valve function is achieved e.g., BALL.	text	/
	Flow Coefficient	Flow coefficient (the quantity of fluid that passes through a fully open valve at unit pressure drop), typically expressed as the Kv or Cv value for the valve.	numeric	Kv/Cv
	Working Pressure	The normally expected maximum working pressure of the valve.	numeric	Pa
	Measured Flow Rate	The rate of flow of a fluid measured across the valve.	numeric	l/min
	Measured Pressure Drop	The actual pressure drop in the fluid measured across the valve.	numeric	Pa
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"BathTub" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Color	Principal color of the object.	text	/
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Performance Data			
	Has Grab Handles	Indicates whether the bath is fitted with handles that provide assistance to a bather in entering or leaving the bath.	boolean	YES/NO
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment)	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment)	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"BathTub" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.		
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Color	Principal color of the object.	text	/
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Performance Data			
	Has Grab Handles	Indicates whether the bath is fitted with handles that provide assistance to a bather in entering or leaving the bath.	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"BathTub" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Color	Principal color of the object.	text	/
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Performance Data			
	Has Grab Handles	Indicates whether the bath is fitted with handles that provide assistance to a bather in entering or leaving the bath.	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Shower" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
		Material		
	Shower Stall Material	Material from which the body of the stall is constructed.	text	/
	Door Material	Material from which the door is constructed.	text	/
		Dimensional Data		
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Door Width	Width of the shower door.	numeric	mm
		Performance Data		
	Has Tray	Indicates whether the shower has a separate receptacle that catches the water in a shower and directs it to a waste outlet.	boolean	YES/NO
		Cost		
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^3 / m^2 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^3 €/ m^2
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Shower" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For exa mple, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Shower Stall Material	Material from which the body of the stall is constructed.	text	/
	Door Material	Material from which the door is constructed.	text	/
	Door Handle Material	Material from which the door handle t is constructed.	text	/
		Dimensional Data		
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Height	Nominal or quoted height of the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Door Width	Width of the shower door.	numeric	mm
		Performance Data		
	Has Tray	Indicates whether the shower has a separate receptacle that catches the water in a shower and directs it to a waste outlet.	boolean	YES/NO
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Shower" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Shower Stall Material	Material from which the body of the stall is constructed.	text	/
	Door Material	Material from which the door is constructed.	text	/
	Door Handle Material	Material from which the door handle t is constructed.	text	/
		Dimensional Data		
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Height	Nominal or quoted height of the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Door Width	Width of the shower door.	numeric	mm
		Performance Data		
	Has Tray	Indicates whether the shower has a separate receptacle that catches the water in a shower and directs it to a waste outlet.	boolean	YES/NO
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Bidet" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Product Data			
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Bidet" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Bidet" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Sink" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Product Data			
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Sink" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Sink" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Floor Drain" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Floor Drain" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object	text	/
	Dimensional Data			
	Strainer Height	Nominal height of the strainer.	numeric	mm
	Strainer Diameter	Nominal diameter of the strainer.	numeric	mm
	Outlet Connection Size	Size of the outlet connection from the object.	numeric	mm
	Body Diameter	Nominal diameter of the drain body.	numeric	mm
	Body Height	Nominal height of the drain body.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Floor Drain" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object	text	/
	Dimensional Data			
	Strainer Height	Nominal height of the strainer.	numeric	mm
	Strainer Diameter	Nominal diameter of the strainer.	numeric	mm
	Outlet Connection Size	Size of the outlet connection from the object.	numeric	mm
	Body Diameter	Nominal diameter of the drain body.	numeric	mm
	Body Height	Nominal height of the drain body.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Urinal" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Urinal Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Product Data			
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment)	numeric	€/m^2, €/m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Urinal" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Urinal Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Urinal" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Urinal Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or fitsued workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the bidet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Water Closet" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	WaterCloset Material	Material from which the body of the water closet is constructed.	text	/
	Seat Material	Material from which the seat of the water closet is constructed.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Product Data			
	Mounting Type	The way the toilet is mounted to the floor, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Water Closet" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Valve Material	Material from which the body of the valve is constructed.	text	/
	WaterCloset Material	Material from which the body of the water closet is constructed.	text	/
	Seat Material	Material from which the seat of the water closet is constructed.	text	/
	Dimensional Data			
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the toilet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Water Closet" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Valve Material	Material from which the body of the valve is constructed.	text	/
	WaterCloset Material	Material from which the body of the water closet is constructed.	text	/
	Seat Material	Material from which the seat of the water closet is constructed.	text	/
	Dimensional Data			
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the toilet is mounted to the floor, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Lavatory" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Product Data			
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^3 / m^2 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Lavatory" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Lavatory" / IfcSanitaryTerminal			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Nominal or quoted length of the object.	numeric	mm
	Width	Nominal or quoted width of the object.	numeric	mm
	Depth	Nominal or quoted depth of the object.	numeric	mm
	Drain Size	The size of the drain outlet connection from the object.	numeric	mm
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Mounting Type	The way the sink is mounted to the counter, wall, etc.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Plumbing			
Actor:				
Object:	"Tank" / IfcTank			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length or Diametar	The nominal length or, in the case of a vertical cylindrical tank, the nominal diameter of the tank.	numeric	mm
	Width or Diametar	The nominal width or, in the case of a horizontal cylindrical tank, the nominal diameter of the tank.	numeric	mm
	Depth	The nominal depth of the tank.	numeric	mm
	Performance Data			
	Has Ladder	Indication of whether the tank is provided with a ladder (set TRUE) for access to the top. If no ladder is provided then value is set FALSE.	boolean	YES/NO
	Product Data			
	Nominal Capacity	The total nominal or design volumetric capacity of the tank.	numeric	m^3
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Plumbing			
Actor:				
Object:	"Tank" / IfcTank			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length or Diametar	The nominal length or, in the case of a vertical cylindrical tank, the nominal diameter of the tank.	numeric	m
	Width or Diametar	The nominal width or, in the case of a horizontal cylindrical tank, the nominal diameter of the tank.	numeric	m
	Depth	The nominal depth of the tank.	numeric	m
	Performance Data			
	Has Ladder	Indication of whether the tank is provided with a ladder (set TRUE) for access to the top. If no ladder is provided then value is set FALSE.	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Nominal Capacity	The total nominal or design volumetric capacity of the tank.	numeric	m^3
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Plumbing			
Actor:				
Object:	"Tank" / IfcTank			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length or Diametar	The nominal length or, in the case of a vertical cylindrical tank, the nominal diameter of the tank.	numeric	m
	Width or Diametar	The nominal width or, in the case of a horizontal cylindrical tank, the nominal diameter of the tank.	numeric	m
	Depth	The nominal depth of the tank.	numeric	m
	Performance Data			
	Has Ladder	Indication of whether the tank is provided with a ladder (set TRUE) for access to the top. If no ladder is provided then value is set FALSE.	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Nominal Capacity	The total nominal or design volumetric capacity of the tank.	numeric	m^3
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Cable Tray" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled in schematic layout with approximate size and shape.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom Elevation	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Total length of all segments.	numeric	mm
	Width	The nominal width of the segment.	numeric	mm
	Height	The nominal height of the segment.	numeric	mm
	Performance Data			
	Has Cover	Indication of whether the cable tray has a cover (=TRUE) or not (= FALSE). By default, this value should be set to FALSE..	boolean	YES/NO
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of elements per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Cable Tray" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearancess modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom Elevation	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Total length of all segments.	numeric	mm
	Width	The nominal width of the segment.	numeric	mm
	Height	The nominal height of the segment.	numeric	mm
	Performance Data			
	Has Cover	Indication of whether the cable tray has a cover (=TRUE) or not (= FALSE). By default, this value should be set to FALSE..	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Cable Tray" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearancess modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom Elevation	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Total length of all segments.	numeric	mm
	Width	The nominal width of the segment.	numeric	mm
	Height	The nominal height of the segment.	numeric	mm
	Performance Data			
	Has Cover	Indication of whether the cable tray has a cover (=TRUE) or not (= FALSE). By default, this value should be set to FALSE..	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Conduit" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled in schematic layout with approximate size and shape.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Diameter	Nominal diameter of the conduit.	numeric	mm
	Length	Total length of all segments.	numeric	mm
	Performance Data			
	Is Rigid	Indication of whether the conduit is rigid (= TRUE) or flexible (= FALSE).	boolean	YES/NO
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m² / m³ . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m², €/ m³
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Conduit" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Diameter	Nominal diameter of the conduit.	numeric	mm
	Shape	The shape of the conduit segment.	text	/
	Length	Total length of all segments.	numeric	mm
	Performance Data			
	Is Rigid	Indication of whether the conduit is rigid (= TRUE) or flexible (= FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Conduit" / IfcCableCarrierSegment			
Geometrical information:				
Detail:	Element modelled to accurate size, shape and spacing. Actual clearances modelled. Actual floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Lower End Bottom	Defines the elevation at the bottom of the lower end.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Diameter	Nominal diameter of the conduit.	numeric	mm
	Shape	The shape of the conduit segment.	text	/
	Length	Total length of all segments.	numeric	mm
	Performance Data			
	Is Rigid	Indication of whether the conduit is rigid (= TRUE) or flexible (= FALSE).	boolean	YES/NO
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Switch" / IfcSwitchingDevice			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Performance Data		
	Has Lock	Indication of whether a switching device has a key operated lock (=TRUE) or not (= FALSE).	boolean	YES/NO
	Is Illuminated	An indication of whether there is an illuminated indicator to show that the switch is on (=TRUE) or not (= FALSE).	boolean	YES/NO
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	Number of Gangs	Number of gangs/buttons on this switch.	numeric	/
	Switch Function	Indicates types of switches which differs in functionality e.g., onoffswitch.	text	/
		Cost		
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^3, €/ m^3
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Switch" / IfcSwitchingDevice			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	Nominal height of the switching device.	numeric	mm
	Length	Nominal length of the switching device.	numeric	mm
	Width	Nominal width of the switching device.	numeric	mm
		Performance Data		
	Has Lock	Indication of whether a switching device has a key operated lock (=TRUE) or not (= FALSE).	boolean	YES/NO
	Is Illuminated	An indication of whether there is an illuminated indicator to show that the switch is on (=TRUE) or not (= FALSE).	boolean	YES/NO
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Gangs	Number of gangs/buttons on this switch.	numeric	/
	Set Point	Indicates the setpoint and label. For toggle switches, there are two positions, 0 for off and 1 for on. For dimmer switches, the values may indicate the fully-off and full-on positions, where missing integer values in between are interpolated. For selector switches, the range indicates the available positions.	numeric	/
	Switch Function	Indicates types of switches which differs in functionality e.g., onoffswitch.	text	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Switch" / IfcSwitchingDevice			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	Nominal height of the switching device.	numeric	mm
	Length	Nominal length of the switching device.	numeric	mm
	Width	Nominal width of the switching device.	numeric	mm
		Performance Data		
	Has Lock	Indication of whether a switching device has a key operated lock (=TRUE) or not (= FALSE).	boolean	YES/NO
	Is Illuminated	An indication of whether there is an illuminated indicator to show that the switch is on (=TRUE) or not (= FALSE).	boolean	YES/NO
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Gangs	Number of gangs/buttons on this switch.	numeric	/
	Set Point	Indicates the setpoint and label. For toggle switches, there are two positions, 0 for off and 1 for on. For dimmer switches, the values may indicate the fully-off and full-on positions, where missing integer values in between are interpolated. For selector switches, the range indicates the available positions.	numeric	/
	Switch Function	Indicates types of switches which differs in functionality e.g., onoffswitch.	text	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Transformer" / IfcTransformer			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	The nominal height of the transformer.	numeric	mm
	Length	The nominal length of the transformer.	numeric	mm
	Width	The nominal width of the transformer.	numeric	mm
		Electrical Data		
	Maximum Apparent Power	Maximum apparent power/capacity in VA (volt am pere).	numeric	VA
	Primary Apparent Power	The power in VA (volt ampere) that has been transformed and that runs into the transformer on the primary side.	numeric	VA
	Primary Current	The current that is going to be transformed and that runs into the transformer on the primary side.	numeric	A
	Primary Frequency	The frequency that is going to be transformed and that runs into the transformer on the primary side.	numeric	Hz
	Primary Voltage	The voltage that is going to be transformed and that runs into the transformer on the primary side.	numeric	V
	Real Impedance Ratio	The ratio between the real part of the zero sequence impedance and the real part of the positive impedance (i.e. real part of the short-circuit voltage) of the transformer. Used for three-phase transformer which includes a N-conductor.	numeric	/
	Short Circuit Voltage	A complex number that specifies the real and imaginary parts of the short-circuit voltage at rated current of a transformer given in %.	numeric	V
	Transformer Vector Group	Possible vector groups for the transformer from which that required may be set. Values in the enumeration list follow a standard international code where the first letter describes how the primary windings are connected, the second letter describes how the secondary windings are connected, and the numbers describe the rotation of voltages and currents from the primary to the secondary side in multiples of 30 degrees. D: means that the windings are delta-connected. Y: means that the windings are star-connected. Z: means that the windings are zig-zag connected (a special start-connected providing low reactance of the transformer); The connectivity is only relevant for three-phase transformers.	text	/
		Cost		
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment)	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Transformer" / IfcTransformer			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	The nominal height of the transformer.	numeric	mm
	Length	The nominal length of the transformer.	numeric	mm
	Width	The nominal width of the transformer.	numeric	mm
		Electrical Data		
	Maximum Apparent Power	Maximum apparent power/capacity in VA (volt ampere).	numeric	VA
	Primary Apparent Power	The power in VA (volt ampere) that has been transformed and that runs into the transformer on the primary side.	numeric	VA
	Primary Current	The current that is going to be transformed and that runs into the transformer on the primary side.	numeric	A
	Primary Frequency	The frequency that is going to be transformed and that runs into the transformer on the primary side.	numeric	Hz
	Primary Voltage	The voltage that is going to be transformed and that runs into the transformer on the primary side.	numeric	V
	Real Impedance Ratio	The ratio between the real part of the zero sequence impedance and the real part of the positive impedance (i.e. real part of the short-circuit voltage) of the transformer. Used for three-phase transformer which includes a N-conductor.	numeric	/
	Secondary Apparent Power	The power in VA (volt ampere) that has been transformed and is running out of the transformer on the secondary side.	numeric	VA
	Secondary Current	The current that has been transformed and is running out of the transformer on the secondary side.	numeric	A
	Secondary Frequency	The frequency that has been transformed and is running out of the transformer on the secondary side.	numeric	Hz
	Secondary Voltage	The voltage that has been transformed and is running out of the transformer on the secondary side.	numeric	V
	Short Circuit Voltage	A complex number that specifies the real and imaginary parts of the short-circuit voltage at rated current of a transformer given in %.	numeric	V
	Transformer Vector Group	Possible vector groups for the transformer from which that required may be set. Values in the enumeration list follow a standard international code where the first letter describes how the primary windings are connected, the second letter describes how the secondary windings are connected, and the numbers describe the rotation of voltages and currents from the primary to the secondary side in multiples of 30 degrees. D: means that the windings are delta-connected. Y: means that the windings are star-connected. Z: means that the windings are zig-zag connected (a special start-connected providing low reactance of the transformer); The connectivity is only relevant for three-phase transformers.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Transformer" / IfcTransformer			
Geometrical Information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other buildi ng elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	The nominal height of the transformer.	numeric	mm
	Length	The nominal length of the transformer.	numeric	mm
	Width	The nominal width of the transformer.	numeric	mm
		Electrical Data		
	Maximum Apparent Power	Maximum apparent power/capacity in VA (volt ampere).	numeric	VA
	Primary Apparent Power	The power in VA (volt ampere) that has been transformed and that runs into the transformer on the primary side.	numeric	VA
	Primary Current	The current that is going to be transformed and that runs into the transformer on the primary side.	numeric	A
	Primary Frequency	The frequency that is going to be transformed and that runs into the transformer on the primary side.	numeric	Hz
	Primary Voltage	The voltage that is going to be transformed and that runs into the transformer on the primary side.	numeric	V
	Real Impedance Ratio	The ratio between the real part of the zero sequence impedance and the real part of the positive impedance (i.e. real part of the short-circuit voltage) of the transformer. Used for three-phase transformer which includes a N-conductor.	numeric	/
	Secondary Apparent Power	The power in VA (volt ampere) that has been transformed and is running out of the transformer on the secondary side.	numeric	VA
	Secondary Current	The current that has been transformed and is running out of the transformer on the secondary side.	numeric	A
	Secondary Frequency	The frequency that has been transformed and is running out of the transformer on the secondary side.	numeric	Hz
	Secondary Voltage	The voltage that has been transformed and is running out of the transformer on the secondary side.	numeric	V
	Short Circuit Voltage	A complex number that specifies the real and imaginary parts of the short-circuit voltage at rated current of a transformer given in %.	numeric	V
	Transformer Vector Group	Possible vector groups for the transformer from which that required may be set. Values in the enumeration list follow a standard international code where the first letter describes how the primary windings are connected, the second letter describes how the secondary windings are connected, and the numbers describe the rotation of voltages and currents from the primary to the secondary side in multiples of 30 degrees. D: means that the windings are delta-connected. Y: means that the windings are star-connected. Z: means that the windings are zig-zag connected (a special start-connected providing low reactance of the transformer); The connectivity is only relevant for three-phase transformers.	text	/
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Performance Data		
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
		Cost		
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical Information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	The nominal height of the outlet.	numeric	mm
	Width	The nominal width of the outlet.	numeric	mm
		Performance Data		
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical Information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	The nominal height of the outlet.	numeric	mm
	Width	The nominal width of the outlet.	numeric	mm
		Performance Data		
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Performance Data			
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Product Data			
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	The nominal height of the outlet.	numeric	mm
	Width	The nominal width of the outlet.	numeric	mm
	Performance Data			
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Outlet" / IfcOutlet			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	The nominal height of the outlet.	numeric	mm
	Width	The nominal width of the outlet.	numeric	mm
	Performance Data			
	Is Pluggable Outlet	Indication of whether the outlet accepts a loose plug connection (= TRUE) or whether it is directly connected (= FALSE) or whether the form of connection has not yet been determined (= UNKNOWN).	boolean	YES/NO/UNKNOWN
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Number of Sockets	The number of sockets that may be connected. In case of inconsistency, sockets defined on ports take precedence.	numeric	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Distribution Board" / IfcElectricDistributionBoard			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Performance Data			
	Requires Qualified Operator	Identifies if the current instance requires a skilled person or instructed person to perform operations on the distribution board (TRUE) or not.	boolean	YES/NO
	Is Main or SubMain	Identifies if the current instance is a main distribution point or topmost level in an electrical distribution hierarchy (TRUE) or not.	boolean	YES/NO
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Number of Poles	The number of live lines that is intended to be handled by the device.	numeric	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3 . It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^3, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Distribution Board" / IfcElectricDistributionBoard			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Nominal height of the board.	numeric	mm
	Width	Nominal width of the board	numeric	mm
	Performance Data			
	Requires Qualified Operator	Identifies if the current instance requires a skilled person or instructed person to perform operations on the distribution board (TRUE) or not.	boolean	YES/NO
	Is Main or SubMain	Identifies if the current instance is a main distribution point or topmost level in an electrical distribution hierarchy (TRUE) or not.	boolean	YES/NO
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Number of Poles	The number of live lines that is intended to be handled by the device.	numeric	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Distribution Board" / IfcElectricDistributionBoard			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Nominal height of the board.	numeric	mm
	Width	Nominal width of the board	numeric	mm
	Performance Data			
	Requires Qualified Operator	Identifies if the current instance requires a skilled person or instructed person to perform operations on the distribution board (TRUE) or not.	boolean	YES/NO
	Is Main or SubMain	Identifies if the current instance is a main distribution point or topmost level in an electrical distribution hierarchy (TRUE) or not.	boolean	YES/NO
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Number of Poles	The number of live lines that is intended to be handled by the device.	numeric	/
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Light Fixture" / IfcLightFixture			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Nominal height of the light fixture.	numeric	mm
	Width / Length or Diametar	Nominal width / length or diameter.	numeric	mm
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Product Data			
	Placing Type	Type of placing specification e.g., ceiling.	text	/
	Mounting Type	The way the light fixture is mounted e.g., freestanding.	text	/
	Cost			
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Light Fixture" / IfcLightFixture			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Nominal height of the light fixture.	numeric	mm
	Width / Length or Diametar	Nominal width / length or diameter.	numeric	mm
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Maximum Plenum Sensible Load	Maximum or Peak sensible thermal load contributed to return air plenum by the light fixture.	numeric	W
	Maximum Space Sensible Load	Maximum or Peak sensible thermal load contributed to the conditioned space by the light fixture.	numeric	W
	Number of Sources	Number of sources.	numeric	/
	Sensible Load to Radiant	Percent of sensible thermal load to radiant heat.	numeric	%
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Placing Type	Type of placing specification e.g., ceiling.	text	/
	Mounting Type	The way the light fixture is mounted e.g., freestanding.	text	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Light Fixture" / IfcLightFixture			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Nominal height of the light fixture.	numeric	mm
	Width / Length or Diametar	Nominal width / length or diameter.	numeric	mm
	Electrical Data			
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Wattage	The amount of power device produces.	numeric	W
	Maximum Plenum Sensible Load	Maximum or Peak sensible thermal load contributed to return air plenum by the light fixture.	numeric	W
	Maximum Space Sensible Load	Maximum or Peak sensible thermal load contributed to the conditioned space by the light fixture.	numeric	W
	Number of Sources	Number of sources.	numeric	/
	Sensible Load to Radiant	Percent of sensible thermal load to radiant heat.	numeric	%
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Placing Type	Type of placing specification e.g., ceiling.	text	/
	Mounting Type	The way the light fixture is mounted e.g., freestanding.	text	/
	Installation Data			
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
	Warranty Data			
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
	Cost			
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

REQUIREMENTSSpecificator - MEP

Information Delivery Milestone:	Design			
Purpose:	Electrical			
Actor:				
Object:	"Lamp" / IfcLamp			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Single color fill			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height or Diametar	The nominal height or diameter of the lamp.	numeric	mm
	Width or Diametar	The nominal width or diameter of the lamp.	numeric	mm
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
		Product Data		
	Color Appearance	In both the DIN and CIE standards, artificial light sources are classified in terms of their color appearance.	text	/
	Color Rendering Index	The CRI indicates how well a light source renders eight standard colors compared to perfect reference lamp with the same color temperature.	numeric	CRI
	Color Temperature	The color temperatures of the commonest artificial light sources range from less than 3000K (warm white) to 4000K (intermediate) and over 5000K (daylight).	numeric	K
	Contributed Luminous Flux	Luminous flux is a photometric measure of radiant flux, i.e. the volume of light emitted from a light source.	numeric	lm
		Cost		
	Estimated Cost	Estimated cost for installing one unit. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€
	Estimated Unit Cost	Estimated cost of element per m^2 / m^3. It is based on the average amount of needed resources (including material, labor and equipment).	numeric	€/m^2, €/ m^3
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Construction			
Purpose:	Electrical			
Actor:				
Object:	"Lamp" / IfcLamp			
Geometrical information:				
Detail:	Element modelled to nominal dimensions and geometry. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height or Diametar	The nominal height or diameter of the lamp.	numeric	mm
	Width or Diametar	The nominal width or diameter of the lamp.	numeric	mm
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Color Appearance	In both the DIN and CIE standards, artificial light sources are classified in terms of their color appearance.	text	/
	Color Rendering Index	The CRI indicates how well a light source renders eight standard colors compared to perfect reference lamp with the same color temperature.	numeric	CRI
	Color Temperature	The color temperatures of the commonest artificial light sources range from less than 3000K (warm white) to 4000K (intermediate) and over 5000K (daylight).	numeric	K
	Contributed Luminous Flux	Luminous flux is a photometric measure of radiant flux, i.e. the volume of light emitted from a light source.	numeric	lm
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

Information Delivery Milestone:	Operation			
Purpose:	Electrical			
Actor:				
Object:	"Lamp" / IfcLamp			
Geometrical information:				
Detail:	Element modelled to actual dimensions and geometry. Actual clearances and supports modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Room Name	Room name where component to be/is installed.	text	/
	Room Number	Room number where component to be/is installed.	text	/
	Offset from Level	Specifies the elevation of the element relative to its level.	numeric	m
	Level	Defines the reference level.	text	/
	Description	An alphanumeric value providing a concise description of the element.	text	/
	Manufacturer	The organization that manufactured and / or assembled the item.	text	/
	URL	A valid URL hyperlink to the manufacturer's website.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height or Diametar	The nominal height or diameter of the lamp.	numeric	mm
	Width or Diametar	The nominal width or diameter of the lamp.	numeric	mm
		Electrical Data		
	Voltage	The voltage that a device is designed to handle.	numeric	V
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Color Appearance	In both the DIN and CIE standards, artificial light sources are classified in terms of their color appearance.	text	/
	Color Rendering Index	The CRI indicates how well a light source renders eight standard colors compared to perfect reference lamp with the same color temperature.	numeric	CRI
	Color Temperature	The color temperatures of the commonest artificial light sources range from less than 3000K (warm white) to 4000K (intermediate) and over 5000K (daylight).	numeric	K
	Contributed Luminous Flux	Luminous flux is a photometric measure of radiant flux, i.e. the volume of light emitted from a light source.	numeric	lm
		Installation Data		
	Installation date	The date on which the installation was carried out.	date time	date
	Subcontractor	A firm or person that carries out installation work.	text	/
	Installation Serial Number/Tag	The identifier assigned to installation.	numeric	/
	Approved By	A person responsible for assuring the quality and meeting the requirements of the installed element.	text	/
		Warranty Data		
	Warranty ID	The identifier assigned to a warranty.	text	/
	WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	text	/
	Warranty Start Date	The date on which the warranty commences.	date time	date
	Warranty End Date	The date on which the warranty expires.	date time	date
	Condition	The physical status of the element at the time of the inventory or audit, based on the best judgment of those persons familiar with the physical characteristics and condition.	text	/
	Defects	Basic imperfection that implies any deformity in component of a building that is owing to blemished plan, inadequate or flawed workmanship or deficient material and once in a while any blend of these.	text	/
		Cost		
	Overall Cost	Sum of all costs needed for installing.	numeric	€
	Installation Cost	Cost of installing one unit, including workforce and equipment.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:				

APPENDIX 6: III TIER: COST ESTIMATION

REQUIREMENTSSpecificator - Design Specific Requirements

COST ESTIMATION

1 Structural Types

Elements that are from the construction perspective considered different structural types shall be modelled as individual types.

* e.g., wooden walls of different heights, that are constructed differently

2 Resource Naming

All resources shall follow the same naming convention.

* This allows grouping the quantities of each resource.

3 Ceiling drops and coves

Ceiling drops and coves shall be modelled as walls containing the same layers as ceiling.

*Up to 300mm they are quantified in metres.

4 Compound elements

Every layer of compound element shall be modelled as to present the accurate dimensions of the accurate construction.

5 Reinforced structures and formwork in concrete elements

If not modelled, reinforced structures and formwork quantities shall be obtained from modelled geometry using ratios provided by structural designer.

*Amount of reinforcement weight per unit of volume for each element category (proposed by Mauricio Morales, BIMMS)

Element Category	Reinforcement weight per unit of volume (kg/m^3)
Beams	300
Columns	325
Ground Concrete Slab	65
Concrete Slab	110
Concrete Walls	120
Foundation Isolated Slab	85
Foundation Beam	280
Foundation Floating Slab	20

6 Commercial size

Specifying the size according to provided list of commercial sizes: piping,cable trays and ducting.

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Wall" / IfcWall**			
Geometrical information:				
Detail:	Element modeled to accurate dimensions. All connections, ornate details and openings modelled to rough-opening dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the wall.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line.	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Height of the element from the upper edge of the bottom slab to the lower edge of the upper slab	numeric	mm
	Exposed Height	Height of the element from the finish floor level of the bottom storey to the finish ceiling level.	numeric	mm
	NetSideArea	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m²
	NetVolume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m³
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Floor" / IfcCovering**			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations, openings and connections modelled to rough dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Finish	The type of finish for the floor.	text	/
	Dimensional Data			
	Width / Thickness	Nominal thickness of the plate.	numeric	mm
	Gross Area	Gross areas of the covering facing the space. No opening that are included in the covering is subtracted.	numeric	m²
	Net Area	Net area of the covering facing the space. All openings that are included in the covering are subtracted.	numeric	m²
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Ceiling" / IfcCovering**			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations, openings and connections modelled to rough dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Structure	The primary material used to construct the structural layer.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Tile length/width	Size of the ceiling tiles.	numeric	mm
	Dimensional Data			
	Thickness	Nominal thickness of the plate.	numeric	mm
	Gross Area	Gross areas of the covering facing the space. No opening that are included in the covering is subtracted.	numeric	m^2
	Net Area	Net area of the covering facing the space. All openings that are included in the covering are subtracted.	numeric	m^2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Door" / IfcDoor**			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Panel Material	The primary material used to construct the panel.	text	/
	Frame Material	The primary material used to construct the frame.	text	/
	Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Panel Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Dimensional Data			
	Area	Total area of the outer lining of the door.	numeric	m^2
	Height	Total outer heigth of the door lining.	numeric	mm
	Width	Total outer width of the door lining.	numeric	mm
	Opening Height	Total height of the wall opening.	numeric	mm
	Opening Width	Total width of the wall opening.	numeric	mm
	Product Data			
	ModelLabel	Descriptive model name of the product model (or product line) as assigned by the manufacturer e.g., Solid Timber Door.	text	/
	ModelReference	Model number or designator of the product (or product line) as assigned by the manufacturer e.g., D639AD.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Window" / IfcWindow			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Frame Material	The primary material used to construct the frame.	text	/
	External Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Internal Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Sill Material	The primary material used to construct the sill.	text	/
	Stool Material	The primary material used to construct the stool.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Dimensional Data			
	Area	Total area of the outer lining of the window.	numeric	m²
	Window Height	Total outer height of the window lining.	numeric	mm
	Window Width	Total outer width of the window lining.	numeric	mm
	Opening Height	Total height of the wall opening.	numeric	mm
	Opening Width	Total width of the wall opening.	numeric	mm
	* Depending on the purpose of the Cost Estimation, Dimensional Data may require more measurements.			
	Frame Depth	Depth of panel frame, measured from front face to back face horizontally (i.e. perpendicular to the window (elevation) plane.	numeric	mm
	Frame Thickness	Width of panel frame, measured from inside of panel (at glazing) to outside of panel (at lining), i.e. parallel to the window (elevation) plane.	numeric	mm
	Frame Area	Total area of the frame.	numeric	m²
	Product Data			
	ModelLabel	Descriptive model name of the product model (or product line) as assigned by the manufacturer e.g., Solid Timber Door.	text	/
	ModelReference	Model number or designator of the product (or product line) as assigned by the manufacturer e.g., D639AD.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Roof" / IfcRoof			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All penetrations modelled to rough-opening dimensions. Framing modelled as separate assembly.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	* Depending on the purpose of the Cost Estimation, Material descriptions may vary in detail e.g., stone wool or stone wool board insulation composed of rock fibers.			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Thickness	The nominal overall thickness.	numeric	mm
	Thermal LayerThickness	The nominal thickness of the insulation.	numeric	mm
	Slope	Sloping angle - relative to horizontal (0.0 degrees)	numeric	degree °
	Gross Area	Total gross area of the outer surface of the roof. It is the sum of all roof slab gross areas. Roof openings, like sky windows and other openings and cut-outs are not taken into account.	numeric	m²
	Net Area	Total net area of the outer surface of the roof. It is the sums of all roof slab net areas. Roof openings, like sky windows and other openings and cut-outs are taken into account.	numeric	m²
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Stairs" / IfcStairs			
Geometrical information:				
Detail:	Element modelled to accurate dimensions and geometry. Stair support elements modelled. Accurate presentation of handrails.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Dimensional Data			
	Number of Riser	Total number of the risers included in the stair.	numeric	/
	Number of Treads	Total number of treads included in the stair.	numeric	/
	Riser Height	Vertical distance from tread to tread. The riser height is supposed to be equal for all steps of a stair or stair flight.	numeric	mm
	Tread Length	Horizontal distance from the front of the thread to the front of the next tread. The tread length is supposed to be equal for all steps of the stair or stair flight at the walking line.	numeric	mm
	Length (Flight)	Total length of the stair flight along the walking line.	numeric	m
	Gross Volume (Flight)	Total gross volume of the stair flight. Openings, recesses, and projections are not taken into account.	numeric	m^3
	Net Volume (Flight)	Total net volume of the stair flight. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^3
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Structural Wall" / ifcWall			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to rough-opening dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Dimensional Data			
	Length	Total nominal length of the wall along the wall center line.	numeric	mm
	Width	Total nominal width (or thickness) of the wall measured perpendicular to the wall path.	numeric	mm
	Height	Height of the element from the upper edge of the bottom slab to the lower edge of the upper slab.	numeric	mm
	Exposed Height	Height of the element from the finish floor level of the bottom storey to the finish ceiling level.		mm
	Net Side Area	Area of the wall as viewed by an elevation view of the middle plane. It does take into account all wall modifications (such as openings).	numeric	m^2
	Net Volume	Volume of the wall, after subtracting the openings and after considering the connection geometry.	numeric	m^3
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Column" / IfcColumn			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to actual dimensions. *Element may include reinforcing, anchors and other embedded objects.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Total length of the column.	numeric	mm
	Section Dimensions/Diametar	Width and depth / diametar of the column section.	numeric	mm
	*If steel/Weight	The weight of the steel per unit length.	numeric	kg/l
	*If Concrete/Precast/Gross Volume	Volume of the column, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Precast/Net Volume	Volume of the column, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the column (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m^2
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Slab" / IfcSlab			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. All connections, openings and joints modelled to actual dimensions. *Element may include reinforcing and post tension elements.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used to construct the structural deck layer.	text	/
	Dimensional Data			
	Thickness	Nominal thickness of the slab.	numeric	mm
	Gross Area	Total area of the extruded area of the slab. Openings, recesses and projections are not taken into account.	numeric	m^2
	Net Area	Total area of the extruded area of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^2
	Gross Volume	Total gross volume of the slab. Openings, recesses, and projections are not taken into account.	numeric	m^3
	Net Volume	Total net volume of the slab. Openings and recesses are taken into account by subtraction, projections by addition.	numeric	m^3
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
	Bottom Formwork	Area of Bottoom Formwork	numeric	m2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Foundation" / IfcFooting / IfcPile			
Geometrical Information:				
Detail:	Element modelled to accurate dimensions. All penetrations and joints modelled to actual dimensions. *Element may include reinforcing and post tension elements.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that differentiates objects.	text	/
		Material		
	Structural Material	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used to construct the structural deck layer.	text	/
		Dimensional Data		
	Width	Total nominal width (or thickness) of the footing. For strip footings it is measured perpendicular to the footing path (or longitudial axis). For other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	mm
	Length	Length of the footing, not taking into account any cut-out's or other processing features. For strip footings it is measured along the path, for other footings it is one of the horizontal dimensions. It should only be provided, if it is constant.	numeric	mm
	Height	Total nominal height of the footing.	numeric	mm
	*If pile/Depth	Total length of the pile not taking into account any cut-out's or other processing features.	numeric	mm
	*If pile/Diameter	Diameter of the cross section of the pile.	numeric	mm
	*If precast/Cap Height	Total nominal height of the cap.	numeric	mm
	*If precast/Cap Length	Total nominal length of the cap.	numeric	mm
	*If precast/Cap Width	Total nominal width of the cap.	numeric	mm
	Gross Surface Area	Total area of the footing, normally generated as perimeter * length + 2 * cross section area. It is the sum of OuterSurfaceArea + (2 x CrossSectionArea) and shall only be given, if the OuterSurfaceArea and CrossSectionArea cannot be established separately.	numeric	m²
	Outer Surface Area	Total area of the exhaled surfaces of the footing (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m²
	Net Volume	Total net volume of the footing, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
	Gross Volume	Total gross volume, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m³
		Structural Data		
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
	Bottom Formwork	Area of Bottoem Formwork	numeric	m2
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Beam" / IfcBeam			
Geometrical information:				
Detail:	Element modelled to accurate dimensions. All connections, ornate details and openings modelled to actual dimensions. *Element may include reinforcing, anchors and other embedded objects.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that differentiates objects.	text	/
	Material			
	Structural Material	The primary material used to construct the structural layer.	text	/
	*If Steel/Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	*If Steel/Section Dimensions	Dimensions of the cross section (or profile) of the beam.	numeric	mm
	Length	Total length of the beam, not taking into account any cut-out's or other processing features.	numeric	mm
	*If Steel/Weight	The weight of the steel per unit length.	numeric	kg/l
	*If Concrete/Precast/Height	Nominal Height of the element.	numeric	m
	*If Concrete/Precast/Width	Nominal Width of the element.	numeric	m
	*If Concrete/Precast/Gross Volume	Total gross volume of the beam, not taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Precast/Net Volume	Total net volume of the beam, taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^3
	*If Concrete/Outer Surface Area	Total area of the extruded surfaces of the object (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	m^2
	*If Concrete/Net Surface Area	Net surface area of the object, normally generated as perimeter * length + 2 * cross section area taking into account possible processing features (cut-out's, etc.) or openings and recesses.	numeric	m^2
	Structural Data			
	*If Concrete/Reinforcement weight per unit of volume (for each size of the rebar)	Weight of reinforcement calculated per unit of volume.	numeric	kg/m3
	*If Concrete/Reinforcement quantity (for each size of the rebar)	Quantity of reinforcement of different size for the unit.	numeric	kg
	*If Concrete/Total Reinforcement quantity	Total quantity of reinforcement needed for the unit.	numeric	kg
	Latteral Formwork	Area of Latteral Formwork	numeric	m2
	Bottom Formwork	Area of Bottoom Formwork	numeric	m2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Duct" / IfcDuctSegment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that differentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Width	The nominal diameter or width of the duct segment.	numeric	mm
	Height	The nominal height of the duct segment.	numeric	mm
	Outer Surface Area	Total area of the extruded surfaces of the object (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	mm^2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Duct Fitting" / IfcDuctFitting**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled. Nominal floor and wall penetration elements modeled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Material			
	Material	The primary material used to construct the object	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	The length of the object. Calculated at midpoint of cross-section and equal to the distance along the flow path from the port inlet to the port outlet. For junction fittings, it indicates the length of the longest flow path.	numeric	mm
	Diameter / Width	The nominal diameter or width of the duct segment.	numeric	mm
	*if rectangular/Height	The nominal height of the duct segment.	numeric	mm
	Outer Surface Area	Total area of the extruded surfaces of the object (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	mm^2
	Performance Data			
	Has Exterior Insulation	TRUE if the duct has exterior insulation. FALSE if it does not.	bolean	YES/NO
	*if insulated/Insulation Material	The primary material used to construct the object	text	/
	*if insulated/Insulation Thickness	Thickness of insulation.	numeric	mm
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Air Terminal" / IfcAirTerminal**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a system.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
	Total Surface Area	Total surface area of the element.	numeric	mm^2
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Coil" / IfcCoil**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Chiller" / IfcChiller**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Boiler" / IfcBoiler			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"AirConditioning" / IfcUnitaryEquipment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Piping" / IfcPipeSegment**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the element.	numeric	mm
	Diameter	The nominal diameter of the pipe segment.	numeric	mm
	Outer surface area	Total area of the extruded surfaces of the pipe (not taking into account the end cap areas), normally generated as perimeter * length.	numeric	mm^2
	Performance Data			
	Has Exterior Insulation	TRUE if the duct has exterior insulation. FALSE if it does not.	bolean	YES/NO
	*if Insulated/Insulation Material	The primary material used to construct the object.	text	/
	*if Insulated/Insulation Thickness	Thickness of insulation.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Valve" / IfcValve**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Actual clearances modelled.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
	Property	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Valve Material	The primary material used to construct the valve.	text	/
	Pipe Material	The primary material used to construct the pipe.	text	/
	Dimensional Data			
	Size	The size of the connection to the valve (or to each connection for faucets, mixing valves, etc.)	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"BathTub" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Color	Principal color of the object.	text	/
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Depth	Depth of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Bidet" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Depth	Depth of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Sink" / IfcSanitaryTerminal**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Sink Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Depth	Depth of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Floor Drain" / IfcSanitaryTerminal**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Outlet Connection Size	Size of the outlet connection from the object.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Urinal" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Depth	Depth of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Water Closet" / IfcSanitaryTerminal			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity.	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Valve Material	The primary material used to construct the object.	text	/
	Water Closet Material	The primary material used to construct the object.	text	/
	Seat Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Depth	Depth of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Lavatory" / IfcSanitaryTerminal**			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Valve Material	The primary material used to construct the object.	text	/
	Water Closet Material	The primary material used to construct the object.	text	/
	Seat Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Shower" / IfcSanitaryTerminal**			
Geometrical Information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
		Material		
	Shower Stall Material	The primary material used to construct the object.	text	/
	Door Material	The primary material used to construct the object.	text	/
	Door Handle Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Tank" / IfcTank**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length / Diametar	Length of the element.	numeric	mm
	Width / Diametar	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Cable Tray" / IfcCableVarrierSegment**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length / Diametar	Length of the element.	numeric	mm
	Width / Diametar	Width of the element.	numeric	mm
	Height	Height of the element.	numeric	mm
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Conduit" / IfcCableVarrierSegment			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Length	Length of the element.	numeric	mm
	Diametar	Diametar of the element.	numeric	mm
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Switch" / IfcSwitchingDevice			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Number of gangs	Height of the element.	numeric	/
	Height	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Transformer" / IfcTransformer**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	Height of the element.	numeric	mm
	Length	Length of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	**Construction**			
Purpose:	**Cost Estimation**			
Actor:				
Object:	**"Outlet" / IfcOutlet**			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Height	Height of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
		Product Data		
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
		Cost		
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Light Fixture" / IfcLightFixture			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height / Diametar	Height of the element.	numeric	mm
	Width / Diametar	Width of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			
Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Distribution Board" / IfcElectricDistributionBoard			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Predefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	Height of the element.	numeric	mm
	Width	Width of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

Information Delivery Milestone:	Construction			
Purpose:	Cost Estimation			
Actor:				
Object:	"Lamp" / IfcLamp			
Geometrical information:				
Detail:	Element modelled to nominal size, shape and spacing. Representation can be simplified.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Preciefined Type	Holds the entity specific enumeration of predefined types to further classify the entity	text	/
	Classification	Classification code according to chosen classification system.	text	/
	Level	Defines the reference level.	text	/
	Type Mark	An alphanumeric value that diferentiates objects.	text	/
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height / Diametar	Height of the element.	numeric	mm
	Width / Diametar	Width of the element.	numeric	mm
	Product Data			
	ModelLabel	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product.	text	/
	ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	text	/
	Cost			
	Labor Cost	Cost of workforce for installing one unit.	numeric	€
	Equipment Cost	Cost of equipment for installing one unit.	numeric	€
	Material Cost	Cost of material for installing one unit.	numeric	€
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	bill of quantities, bill of materials			

APPENDIX 7: III TIER: ENERGY ANALYSIS

REQUIREMENTSSpecificator - Energy Analysis

ENERGY ANALYSIS	
1	**Location**
Model shall have specified Location/Project Address.	
2	**Weather Station**
Model shall have weather station defined.	
3	**Analytical Surface Resolution**
Analytical Surface Resolution should be less than the smallest dimension of any surface to be included in energy model.	
4	**Surrounding buildings**
All external shadowing buildings shall be modelled as mass blocks. They shall not contain mass floors.	
5	**Ground Plane**
Model shall have ground plane defined.	
6	**Massing**
All masses that represent analysed building shall have mass floors defined.	
7	**In-place families**
Using In-place families should be avoided. *There is a possibility of not being properly translated to energy analysis tool.	
8	**Materials**
Every element shall have defined material layers.	
9	**Compund elements**
Building Elements should be modelled as single integral element that contains layers.	
10	**Sandwiched Elements**
In case of two Wall layers being placed next to each other, only one shall be RoomBounding.	
11	**Wall Centreline**
In case of aligning walls that have different thickness, centerline shall be aligned, not the exterior edge.	
12	**External Elements**
All External Elements shall be marked as Is External.	
13	**Gaps**
Gaps between architectural elements should be avoided.	
14	**Exterior Walls**
Exterior walls should be modelled as continous through all levels.	

REQUIREMENTSSpecificator - Energy Analysis

15	**Walls of different Materials**
Walls that are continous, but made of different materials, shall be modelled separately.	
*Material Thermal Data is different.	
16	**Shading Devices**
Shading devices should be created using wall, roof or mullion families.	
17	**Ceiling Voids**
Depending on the type of analysis, modelling ceilings voids for energy analysis can be:	
Not including ceilings in the energy model or setting them as non-room bounding.	
Setting ceiling as room bounding and modelling ceiling void as Plenum Space.	
Setting ceiling as room bounding, but not modelling separate analytical space.	
18	**Columns**
Depending on their size and impact on reducing the usable floor area, modelling columns for energy analysis should be avoided.	
If included, they should be set as non-room bounding.	
*Excluding columns for energy model does not have large impact on space volume, but avoids issues in analysis softwares.	
19	**Room/Space Placing**
All interior areas shall have room placed e.g., shaft and unoccupied space as well.	
*Rooms are used for differing interior and exterior space. If there is no Room adjacent to another space, then the vertical wall is considered as an Exterior wall.	
20	**Room Bounding Elements**
Elements that form boundaries of rooms shall be assigned as Room Bounding.	
21	**Room Bounding Disabled**
Building Elements located outside of the main building shall have room bounding disabled.	
22	**Area Computations**
Room Area shall be computed at the wall finish.	
23	**Rooms inside Rooms**
Placing rooms inside other Rooms shall be avoided.	
24	**Room Separation Line**
Room Separation Line shall be used only if there is no other element e.g., wall separating two spaces.	
Room Separation Line shall not be placed next to the wall.	
*This can result in bounding issues.	
25	**Space Adjacencies**
Interior Surfaces have spaces on BOTH sides of it.	

REQUIREMENTSSpecificator - Energy Analysis

26	**Space**
Spaces shall be modelled from finished floor to finished ceiling. In case the space contains suspended ceiling, spaces shall be made both for the room space and the plenum area.	
27	**Space overlap**
Spaces shall not overlap. Gross area space objects shall not be included.	
28	**Space Phasing**
All spaces shall be in the same Project Phase as the Project Information.	
29	**Zone-Based Modelling**
All spaces with similar thermal and space characteristics such as solar orientation, occupancy, lighting, and equipment shall be grouped into one Room.	

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Space" / IfcSpace**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Room Number	An assigned room number. This value must be unique for each room in a project.	text	/
	Room Name	The room name e.g., Conference Room.	text	/
	Occupancy Type	Occupancy type for this object.	text	/
	Type of Ventilation	The type of ventilation e.g., natural.	text	/
	Zone Name	The name of the Zone this Space is a part of.	text	/
	Material Data			
	Floor Covering	Label to indicate the material or finish of the space flooring.	text	/
	Wall Covering	Label to indicate the material or finish of the space walls covering.	text	/
	Ceiling Covering	Label to indicate the material or finish of the space ceiling covering.	text	/
	Dimensional Data			
	GrossPlannedArea	Total planned gross area for the space. Used for programming the space.	numeric	m^2
	NetPlannedArea	Total planned net area for the space. Used for programming the space.	numeric	m^2
	Occupancy Data			
	Occupancy Number	Number of people required for the activity assigned to this space.	numeric	/
	Occupancy Time for Day	The amount of time during the day that the activity is required within this space.	numeric	h
	Analytical Data			
	Is Plenum	Indication whether the element is designed as plenum space (TRUE) or not (FALSE).	boolean	YES/NO
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Is Occupied	Indicates if the space is occupiable or not.	boolean	YES/NO
	Natural Ventilation	Indication whether the space is required to have natural ventilation (TRUE) or mechanical ventilation (FALSE).	boolean	YES/NO
	Air Conditioning	Indication whether this space requires air conditioning provided (TRUE) or not (FALSE).	boolean	YES/NO
	Thermal Data			
	Space Temperature Max	Maximal temperature of the space or zone, that is required from user/designer view point. If no summer or winter space temperature requirements are given, it applies all year, otherwise for the intermediate period.	numeric	°C
	Space Temperature Min	Minimal temperature of the space or zone, that is required from user/designer view point. If no summer or winter space temperature requirements are given, it applies all year, otherwise for the intermediate period.	numeric	°C
	Ventilation Data			
	TotalAirflow	The total design supply air flowrate required for the system for either heating or cooling conditions, whichever is greater.	numeric	m3/s.
	EnergyGainTotal	The total amount of energy gains for the spaces served by the system during the peak cooling conditions, plus any system-level total energy gains.	numeric	W
	Air flow rate required during the peak cooling conditions	The amount of air that needs to be circulated through a cooling system.	numeric	m3/s
	Air flow rate required during the peak heating conditions	The amount of air that needs to be circulated through a heating system.	numeric	m3/s
	Design exhaust air flow rate	The volume of air that needs to be removed from a space or system to achieve optimal conditions.	numeric	m3/s
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Zone" / IfcZone			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Occupancy Type	Occupancy type for this object.	text	/
	Type of Ventilation	The type of ventilation e.g., natural.	text	/
	Dimensional Data			
	Volume	Volume of the Zone.	numeric	m^3
	GrossPlannedArea	Total planned gross area for the Zone.	numeric	m^2
	NetPlannedArea	Total planned net area for the Zone.	numeric	m^2
	Analytical Data			
	Is Occupied	Indicates if the space is occupiable or not.	boolean	YES/NO
	Thermal Data			
	Space Temperature Max	Maximal temperature of the space or zone, that is required from user/designer view point. If no summer or winter space temperature requirements are given, it applies all year, otherwise for the intermediate period.	numeric	°C
	Space Temperature Min	Minimal temperature of the space or zone, that is required from user/designer view point. If no summer or winter space temperature requirements are given, it applies all year, otherwise for the intermediate period.	numeric	°C
	Cooling and Heating Data			
	Cooling Set Point	Temperature at which the system will maintain the cooling in all spaces in the zone. You can specify only one set point per zone because a zone controls its spaces using a single thermostat. A cooling set point is specified for each zone.	numeric	°C
	Cooling Air Temperature	Supply air temperature used to cool all spaces in the zone. A cooling air temperature is specified for each zone.	numeric	°C
	Heating Set Point	Temperature at which the system will maintain the heating in all spaces in the zone. You can specify only one set point per zone because a zone controls its spaces using a single thermostat. A heating set point is specified for each zone.	numeric	°C
	Heating Air Temperature	Supply air temperature used to heat all spaces in the zone. A heating air temperature is specified for each zone.	numeric	°C
	Outdoor Air Data			
	Minimum Outdoor Air per Person	The amount of outdoor air required for each person (in a space) for all spaces in the zone.	numeric	L/s/person
	Minimum Outdoor Air per Area	The amount of outdoor air per occupied square area of all spaces in the zone. This value is specified for each zone.	numeric	$L/s/m^2$
	Minimum Air Changes	The number of times per hour that the air volume of all occupied spaces in the zone is replaced. The value is specified for each zone.	numeric	ACH
	Mechanical - Airflow Data			
	Calculated Supply Airflow	The total supply airflow for the zone.	numeric	m^3/s
	Claculated Supply Airflow per area	The Calculated Supply Airflow of the zone divided by the total area of the zone.	numeric	m^3/s
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Wall" / IfcWall**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and thickness.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg°C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Thermal Resistance®	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	$kg\ ft^2/(s^2K)$
	Dimensional Data			
	Layer thickness	Thickness of each individual layer of the wall.	numeric	mm
	Gross Side Area	Area of the wall as viewed by an elevation view of the middle plane of the wall. It does not take into account any wall modifications (such as openings).	numeric	m^2
	Gross Volume	Volume of the wall, without taking into account the openings and the connection geometry.	numeric	m^3
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Is Room Bounding	Indicates whether the object is room bounding (TRUE) or not (FALSE).	boolean	YES/NO
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Flooring" / IfcCovering**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	*If on the ground/Soil Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg*C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Thermal Resistance*	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	$kg\ ft^2/(s^2K)$
	Dimensional Data			
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m^2
	Volume	Net volume of the flooring. All openings that is included in the covering are subtracted.	numeric	m^3
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Is Room Bounding	Indicates whether the object is room bounding (TRUE) or not (FALSE).	boolean	YES/NO
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Ceiling" / IfcCovering**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Material			
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Substrate	The primary material used as a substrate.	text	/
	Thermal/Air Layer	The primary material used as a thermal layer.	text	/
	Membrane Layer	The primary material used as a membrane layer.	text	/
	Structure	The primary material used to construct the structural layer.	text	/
	Structural Deck	The primary material used as a structure deck.	text	/
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m-K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg*C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Thermal Resistance*	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	$kg\ ft^2/(s^2K)$
	Dimensional Data			
	Layer thickness	Thickness of each individual layer of the wall.	numeric	mm
	Thickness	Nominal thickness (or width) of the plate.	numeric	mm
	Area	Sum of all net areas of the covering facing the space. All openings that is included in the covering are subtracted.	numeric	m^2
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Door" / IfcDoor**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Material			
	Panel Material	The primary material used to construct the panel.	text	/
	Frame Material	The primary material used to construct the frame.	text	/
	Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Panel Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg°C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Thermal Resistance®	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	$kg\ ft^2/(s^2K)$
	Dimensional Data			
	Height	Total outer heigth of the door lining.	numeric	mm
	Width	Total outer width of the door lining.	numeric	mm
	Area	Total area of the outer lining of the door.	numeric	m^2
	*If Glazing			
	Glass Thickness	Width of glass panel, measured from inside of the panel to the outside i.e. parallel to the window (elevation) plane.	numeric	mm
	Solar Heat Gain Coefficient	Indicates the fraction of incident solar radiation a window lets through that is then directly transmitted, absorbed and released inward.	numeric	/
	Solar Diffusing	Indication whether the beam solar radiation incident on the glass is transmitted as hemispherically diffuse radiation with no beam component (TRUE) or as beam radiation with no diffuse component (FALSE). If YES the glass is translucent, if NO the glass is transparent.	boolean	YES/NO
	Solar Reflectance	The ratio of incident solar radiation that is reflected by a glazing system.	numeric	ratio
	Solar Absorbtion	The ratio of incident solar radiation that is absorbed by a glazing system. It is the sum of the absorption distributed to the exterior (a) and to the interior (qi).	numeric	ratio
	Visual Light Reflectance	Fraction of the visible light that is reflected by the glazing at normal incidence. It is a value without unit.	numeric	/
	Visual Light Transmittance	Indicates the amount of visible light that passes through a glazing system.	numeric	%
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Window" / IfcWindow			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	OpeningType	Defines whether the window swings inside or away of the room.	text	/
	Material			
	Frame Material	The primary material used to construct the frame.	text	/
	External Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Internal Frame Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Sill Material	The primary material used to construct the sill.	text	/
	Stool Material	The primary material used to construct the stool.	text	/
	Hardware Material	The primary material of the hardware.	text	/
	Fill Gas	Name of the gas by which the gap between two glass layers is filled.	text	/
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg°C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Thermal Resistance	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Solar Heat Gain Coefficient	Indicates the fraction of incident solar radiation a window lets through that is then directly transmitted, absorbed and released inward.	numeric	/
	Solar Diffusing	Indication whether the beam solar radiation incident on the glass is transmitted as hemispherically diffuse radiation with no beam component (TRUE) or as beam radiation with no diffuse component (FALSE). If YES the glass is translucent, if NO the glass is transparent.	boolean	YES/NO
	Solar Reflectance	The ratio of incident solar radiation that is reflected by a glazing system.	numeric	ratio
	Solar Absorbtion	The ratio of incident solar radiation that is absorbed by a glazing system. It is the sum of the absorption distributed to the exterior (αj and to the interior (αi).	numeric	ratio
	Heat Transfer Coefficient	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Visual Light Reflectance	Fraction of the visible light that is reflected by the glazing at normal incidence. It is a value without unit.	numeric	/
	Visual Light Transmittance	Indicates the amount of visible light that passes through a glazing system.	numeric	%
	Dimensional Data			
	Height	Total outer heigth of the window lining.		mm
	Width	Total outer width of the window lining.	numeric	mm
	Glass Thickness	Width of glass panel, measured from inside of the panel to the outside i.e. parallel to the window (elevation) plane.	numeric	mm
	Frame Thickness	Width of panel frame, measured from inside of panel (at glazing) to outside of panel (at lining), i.e. parallel to the window (elevation) plane.	numeric	mm
	Area	Total area of the outer lining of the window.	numeric	m^2
	Glazing Area	Total area of the glazing.	numeric	m^2
	Frame Area	Total area of the frame.	numeric	m^2
	Performance Data			
	Is External	Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.	boolean	YES/NO
	Is Tempered	Indication whether the element is tempered (TRUE) or not (FALSE).	numeric	/
	Is Laminated	Indication whether the glass is layered with other materials (TRUE) or not (FALSE).	boolean	YES/NO
	Is Coated	Indication whether the glass is coated with a material (TRUE) or not (FALSE).	boolean	YES/NO
	Is Wired	Indication whether the glass includes a contained wire mesh to prevent break-in (TRUE) or not (FALSE).	boolean	YES/NO
	* If Shading			
	Shading Type	Specifies the type of the shading e.g., interior blind.	text	/
	Shading Control Type	Specifies how the shading device is controlled.	text	/
	Shading Control is scheduled	Indication whether scheduled shading control exists (TRUE) or not (FALSE).	boolean	YES/NO
	Glare Control is Active	Indication whether the glare control is active (TRUE) or not (FALSE).	boolean	YES/NO
	Shading Material	The primary material used to construct the shading device.	text	/
	*If Blinds/Type of Slat Angle Control for Blinds	Specifies how the slat angle is controlled e.g., FIXED.	text	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Roof" / IfcRoof**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Material			
	Thickness	Nominal thickness (or height) of roof layers measured perpendicular to the roof plane.	numeric	mm
	Layer thickness	Thickness of each individual layer of the roof.	numeric	mm
	Area	Total net area of the outer surface of the roof. It is the suma of all roof slab net areas. Roof openings, like sky windows and other openings and cut-outs are taken into account.	numeric	m^2
	Slope	Angle between roof surface and horizontal plane.	numeric	degrees
	Material Thermal Data			
	*Depending on the type of material, Thermal Data information requirements may very.			
	Thermal Conductivity	Specifies the abilitty of material to conduct heat.	numeric	W/m·K
	Specific Heat	Heat energy per unit mass (typically 1 kg) required to raise the temperature of a substance by one degree Celsius. The higher the specific heat capacity of a substance, the more energy is required to raise its temperature.	numeric	J/kg°C
	Density	Substance's mass per unit of volume.	numeric	kg/l
	Emissivity	The emissivity of the surface of a material is its effectiveness in emitting energy as thermal radiation and varies between 0.0 and 1.0.	numeric	/
	Analytical Data			
	Heat Transfer Coefficient(U)	Coefficient for calculating heat transfer, typically by convection or phase change between a fluid and a solid.	numeric	$W/(m^2*K)$
	Thermal Resistance®	The temperature difference by which an object or material resists a heat flow.	numeric	$(m^2*K)/W$
	Thermal Mass	Specifies the abbility of an element to store heat, the product of each material layer mass, and specific heat capacity.	numeric	kg $ft^2/(s^2K)$
	Performance Data			
	Is UV Resistent	Indication whether the element is resistent to ultra violet rays / sunlight (TRUE) or not (FALSE).	boolean	YES/NO
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Not requested			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Duct" / IfcDuctSegment			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.		
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	Finish selection for this object. Here specification of the surface finish for informational purposes.	text	/
	Dimensional Data			
	Length	Length of the segment, calculated at midpoint of cross-section, equal to the distance between inlet and outlet ports.	numeric	mm
	Width	The nominal width of the duct segment.	numeric	mm
	Height	The nominal height of the duct segment.	numeric	mm
	Diametar	The nominal diameter of the duct segment.	numeric	mm
	Section Area	Area of the cross section, including the duct itself and the interior flow space.	numeric	mm^3
	Analytical Data			
	Outlet/Inlet Node Names	The names of the nodes where the fluid medium enters and exits the heating coil.	text	/
	Maximum Air Flow Rate	The design constant volume flow rate.	numeric	m^3/s
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Air Terminal" / IfcAirTerminal			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.		
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Material			
	Material	The primary material used to construct the object.	text	/
	Finish	The type of finish for the air terminal.	text	/
	Dimensional Data			
	Width	The nominal width of the air terminal.	numeric	mm
	Height	The nominal height of the air terminal.	numeric	mm
	DuctWidth	The nominal width of the duct.	numeric	mm
	DuctHeight	The nominal height of the air terminal.	numeric	mm
	Volume	The nominal width of the air terminal.	numeric	m^3
	Performance Data			
	Has Thermal Insulation	If TRUE, the air terminal has thermal insulation.	boolean	YES/NO
	Analytical Data			
	Maximum AirFlow Rate	The maximum flow rate of air that the air terminal can handle under peak conditions.	numeric	m^3/s
	Outlet Node Name	Outlet node name for the air distribution unit to the attached zone.	text	/
	Inlet Node Name	The air-inlet node name that connects the air splitter to the individual zone ADU.	text	/
	Design AirFlow Rate	The design flow rate of air supplied or extracted by the air terminal.	numeric	m^3/s
	Pressure Control Type	The control method used by the air terminal to maintain a desired pressure setpoint.	text	/
	Damper Control Type	The type of damper control used by the air terminal, such as NoFlow, Controllable, FixedFlow, etc.	text	/
	Minimum Air Flow Fraction	The minimum fraction of the design air flow rate that the air terminal can modulate down to during part-load conditions.	numeric	/
	Heating/Cooling Design Capacity	The design heating and cooling capacities of the air terminal.	numeric	W
	Availability Schedule	A schedule that determines when the air terminal is available to operate.	text	/
	Reheat Coil Availability Schedule	A schedule that determines when the reheat coil in the air terminal is available to provide additional heating.	text	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Coil" / IfcCoil			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.		
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Analytical Data			
	Cooling Capacity	The design capacity of the cooling coil.	numeric	W
	Heating Capacity	The design capacity of the heating coil.	numeric	W
	Inlet/Outlet Node Names	The names of the nodes where the fluid medium enters and exits the heating coil.	text	/
	Heat Exchanger Configuration	The coil is operable in two configurations: CounterFlow or CrossFlow.	text	/
	*If Steam/Maximum Steam Flow Rate	The maximum possible steam volumetric flow rate in m3/s through the steam heating coil.	numeric	m^3/s
	*If Water/Maximum Water Flow Rate	The maximum possible water volume flow rate (m3/sec) through the coil.	numeric	m^3/s
	Maximum Air Flow Rate	The maximum possible air volume flow rate (m3/sec) through the coil.	numeric	m^3/s
	Inlet Water Temperature	The inlet water temperature for the design flow.	numeric	°C
	Outlet Water Temperature	The outlet water temperature corresponding to the rated heating capacity.	numeric	°C
	Inlet Air Temperature	The inlet air temperature for the design flow.	numeric	°C
	Outlet Air Temperature	The outlet air condition desired for design flow.	numeric	°C
	Inlet Air Humidity Ratio	The highest value of humidity ratio possible for the Design inlet air stream.	numeric	kgWater/kgDryAir
	Outlet Air Humidity Ratio	The value of humidity ratio for the Design outlet air stream.	numeric	kgWater/kgDryAir
	Availability Schedule	Schedule that defines when the coil is available. The name of the schedule (ref: Schedule) that denotes whether the coil can run during a given time period. A schedule value greater than 0 (usually 1 is used) indicates that the unit can be on during a given time period. A value less than or equal to 0 (usually 0 is used) denotes that the unit is off. If this field is blank, the schedule has a value of 1 for all time periods.	numeric	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Fan" / IfcFan**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.		
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Analytical Data			
	Maximum Air Flow Rate	This numeric field is the design volume flow rate of fan as installed in the HVAC system, in m3/s..	numeric	m^3/s
	Inlet/Outlet Node Names	The names of the air system nodes at the inlets and outlets of the fan.	text	/
	Speed Control Method	This field is used to select how the fan speed can be varied.	text	/
	Electric Power Minimum Flow Rate Fraction	This numeric field is used to describe how low a variable speed fan can be operated.	numeric	/
	Total Pressure Rise	The Total System Pressure Rise experienced by the fan in Pascals at full flow rate and altitude-adjusted standard density of dry air at 20 degrees Celsius drybulb.	numeric	Pa
	Motor Efficiency	Describes the electric motor that drives the fan. Efficiency is the shaft power divided by the electric power consumed by the motor. The value must be between 0 and 1.	numeric	/
	Motor In Air Stream Fraction	The fraction of the motor heat that is added to the air stream. The value must be between 0 and 1. A value of 0 means fan motor is located completely outside of air stream and none of the motor's heat is added to the air stream. A value of 1.0 means the motor is located completely inside of air stream and all of the motor's heat is added to the air stream.	numeric	/
	Electric Power Consumption	This numeric field is the electric power consumption at the full Design Maximum Air Flow Rate and Design Pressure Rise.	numeric	W
	Fan Efficiency	The efficiency of the fan, typically represented as a decimal value between 0 and 1.	numeric	/
	Availability Schedule	Schedule that determines when the fan is available.	numeric	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

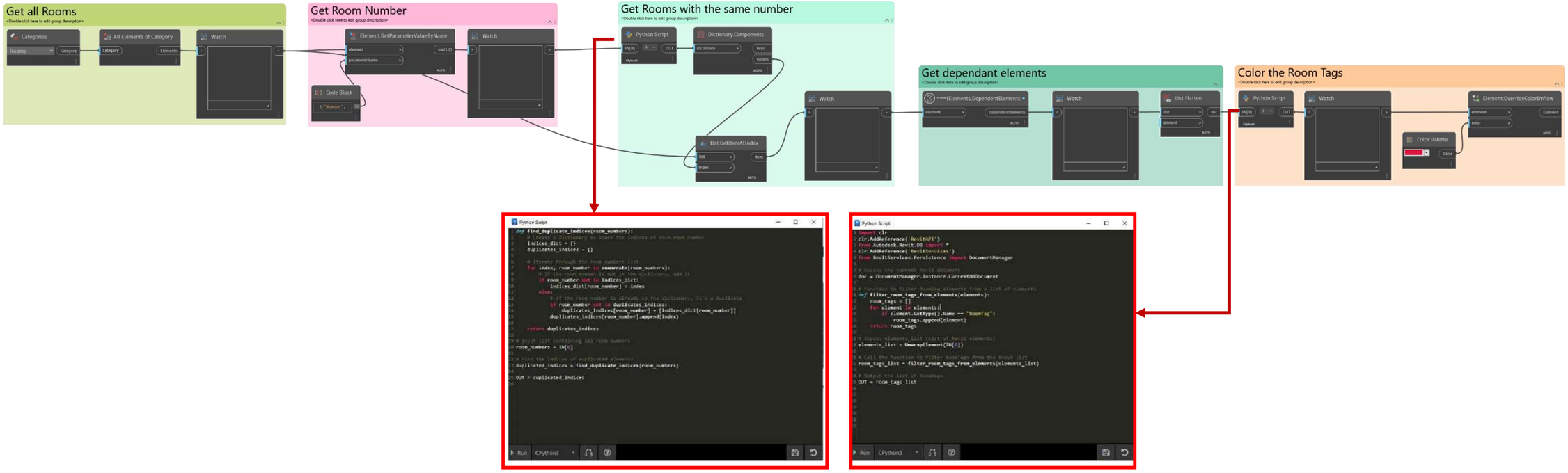
Information Delivery Milestone:	**Design**			
Purpose:	**Energy Analysis**			
Actor:				
Object:	**"Chiller" / IfcChiller**			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	**Property**	**Description**	**Data Type**	**Units**
		Identity Data		
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
		Material		
	Material	The primary material used to construct the object.	text	/
		Dimensional Data		
	Length	The nominal length of the chiller.	numeric	mm
	Width	The nominal width of the chiller.	numeric	mm
	Height	The nominal height of the chiller.	numeric	mm
		Analytical Data		
	Nominal Capacity	The nominal cooling capability of the chiller in Watts.	numeric	W
	Condenser Type	Defines which type of condenser is modelled with chiller.	text	/
	Nominal COP	Contains the chiller's coefficient of performance.For a water-cooled chiller, this number does not include energy use due to condenser pumps and/or fans. For an air-cooled or evap-cooled chiller, this number includes condenser fan power.	numeric	/
	Chilled Water Inlet/Outlet Node Names	Contains the identifying name for the electric chiller plant side inlet / outlet node.	text	/
	Condenser Inlet/Outlet Node Names	Contains the identifying name for the electric chiller condenser side inlet / outlet node.	text	/
	Minimum Part Load Ratio	Chiller's minimum part load ratio. The expected range is between 0 and 1. The minimum part load is not the load where the machine shuts off, but where the amount of power remains constant to produce smaller loads than this fraction.	numeric	/
	Maximum Part Load Ratio	Contains the electric chiller's maximum part load ratio. This value may exceed 1, but the normal range is between 0 and 1.1.	numeric	/
	Optimum Part Load Ratio	Contains the electric chiller's optimum part load ratio. This is the part load ratio at which the chiller performs at its maximum COP.	numeric	/
	Condenser Inlet Temperature	Contains the electric chiller's condenser inlet design temperature in Celsius.	numeric	°C
	Temperature Rise Coefficient	Contains the electric chiller's temperature rise coefficient which is defined as the ratio of the required change in condenser water temperature to a given change in chilled water temperature, which maintains the capacity at the nominal value.	numeric	/
	Chilled Water Outlet Temperature	Contains the electric chiller's evaporator outlet design temperature in Celsius.	numeric	°C
	Chilled Water Flow Rate	For variable volume chiller this is the maximum flow and for constant flow chiller this is the design flow rate.	numeric	m^3/sec
	Minimal Chilled Water Outlet Temperature	Contains the lower limit for the evaporator outlet temperature. This temperature acts as a cut off for heat transfer in the evaporator, so that the fluid doesn't get too cold.	numeric	°C
	Condenser Fluid Flow Rate	Contains the chiller's operating condenser fluid flow rate in cubic meters per second.	numeric	m^3/sec
	Chiller Flow Mode	Determines how the chiller operates with respect to the intended fluid flow through the device's evaporator. There are three different choices for specifying operating modes for the intended flow behavior: "NotModulated," "ConstantFlow," and "LeavingSetpointModulated."	text	/
		Electrical Data		
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
		Phasing		
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Boiler" / IfcBoiler			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Analytical Data			
	Fuel Type	Specifies the type of fuel used by boiler.	text	/
	Nominal Capacity	Nominal operating capacity of the boiler.	numeric	W
	Nominal Thermal Efficiency	Contains the heating efficiency (as a fraction between 0 and 1) of the boiler's burner. This is the efficiency relative to the higher heating value (HHV) of fuel at a part load ratio of 1.0.	numeric	/
	Water Flow Rate	Contains the maximum design water volumetric flow rate in m3/sec. This should be the largest flow rate than can be heated.	numeric	m^3/sec
	Minimum Part Load Ratio	Contains the minimum part load ratio. If the ratio of demand to boiler nominal capacity is less than the minimum part load ratio, then the Min PLR will determine the operating PLR. The expected range is between 0 and 1.	numeric	/
	Maximum Part Load Ratio	Contains the maximum part load ratio. If the ratio of demand to boiler nominal capacity is greater than the maximum part load ratio, then the Max PLR will determine the operating PLR. This value may exceed 1, but the normal range is between 0 and 1.1.	numeric	/
	Optimum Part Load Ratio	This is the part load ratio at which the boiler performs at its maximum efficiency.	numeric	/
	Inlet/Outlet Water Node Names	The names of the water inlet/outlet node names.	text	/
	Water Outlet Upper Temperature Limit	The outlet temperature upper limit.	numeric	°C
	Boiler Flow Mode	Determines how the boiler operates with respect to the intended fluid flow through the device. There are three different choices for specifying operating modes for the intended flow behavior: "NotModulated," "ConstantFlow," and "LeavingSetpointModulated."	text	/
	*If Steam/Maximum Operating Pressure	The maximum value of pressure up to which the boiler would operate, or the maximum design pressure.	numeric	Pa
	*If Steam/Outlet Steam Temperature	The maximum value of steam temperature the boiler can provide.	numeric	°C
	*If Steam/Inlet/Outlet Steam Node Names	The names of the water inlet/outlet node names.	text	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

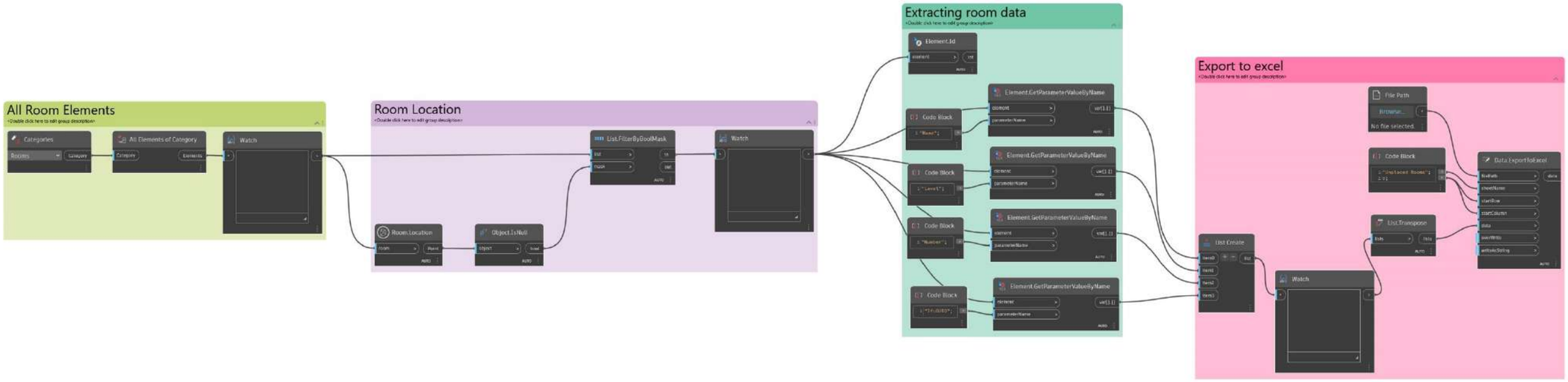
Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"AirConditioning" / IfcUnitaryEquipment			
Geometrical Information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	System Classification	Defines the system for the connectors that are located on air terminals, equipment and fixtures. For example, connectors for air terminals could have a system classification of Supply Air, Return Air or Exhaust Air.	text	/
	System Type	Type of system e.g., supply air.	text	/
	System Name	A name that uniquely defines system. It may be user-defined or automatically generated.	text	/
	System Abbreviation	A user-defined abbreviation for a systen.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Material			
	Material	The primary material used to construct the object.	text	/
	Analytical Data			
	Length	The nominal length of the air conditioning unit.	numeric	mm
	Width	The nominal width of the air conditioning unit.	numeric	mm
	Height	The nominal height of the air conditioning unit.	numeric	mm
	Mechanical Data			
	Heating Capacity	Heating capacity.	numeric	BTU/Hr
	Cooling Capacity	Cooling capacity.	numeric	BTU/Hr
	Condenser Flowrate	Flow rate of fluid through the condenser.	numeric	liter/min
	Cooling Efficiency	Coefficient of Performance: Ratio of cooling energy output to energy input under full load operating conditions.	numeric	/
	Electrical Data			
	Apparent Load	Apparent power device is needed.	numeric	VA
	Voltage	The voltage that a device is designed to handle.	numeric	V
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

Information Delivery Milestone:	Design			
Purpose:	Energy Analysis			
Actor:				
Object:	"Transformer" / IfcTransformer			
Geometrical information:				
Detail:	Simplified volume representation. Modelled accurately in terms of the overall geometry and dimensions.			
Dimensionality:	3D			
Location:	Absolute and relative to other building elements			
Appearance:	Color fill to distinguish different materials			
Parametric behaviour:	Not requested			
Alphanumeric Information:				
Identification:				
Information content:	Property	Description	Data Type	Units
	Identity Data			
	Name	Primary identifier of an object.	text	/
	Type	Defines the object type, specific information about object.	text	/
	Zone Name	The name of the Zone this Wall is a part of.	text	/
	Space Name	The name of the Zone this Wall is a part of.	text	/
	Room Volume	Volume of the room where component to be/is installed.	numeric	m^3
	Material			
	Material	The primary material used to construct the object.	text	/
	Dimensional Data			
	Height	The nominal height of the transformer.	numeric	mm
	Length	The nominal length of the transformer.	numeric	mm
	Width	The nominal width of the transformer.	numeric	mm
	Analytical Data			
	Trasnformer Usage	Indicates one of the three supported transformer application types: PowerInFromGrid, PowerOutToGrid, and LoadCenterPowerConditioning.	text	/
	Radiative Fraction	Contains the fraction of transformer's losses that enter the zone as long-wave thermal radiation. This numeric filed should have a value between 0.0 and 1.0. The balance of the losses is convective.		
	Rated Capacity	Defines the rated capacity of the transformer in VA.	numeric	VA
	Phase	Indicates whether the transformer is a single phase or three phase type. The two alternative values are 1 or 3.	numeric	/
	Full Load Temperature Rise	Defines the temperature rise of the windings above the ambient temperature, when the transformer is loaded at its nameplate rating.	numeric	°C
	Fraction of Eddy Current Losses	Defines the fraction of load losses resulting from the eddy currents. Transformer's load losses comprise two parts: the ohmic loss due to the current flowing in the resistance of the windings and the eddy and stray losses due to the eddy currents. This field indicates the fraction of the load losses due to the eddy currents. This numeric field should have a value between 0.0 and 1.0.	numeric	/
	Nameplate Efficiency	Contains the value for transformer efficiency at a given per unit load and specified reference temperature.	numeric	/
	Per Unit Load for Nameplate Efficiency	Defines the percentage of the rated capacity at which the nameplate efficiency is measured. According to the NEMA (National Electrical Manufactures Association) Standard TP-1, the per unit load takes the value of 0.35 for dry-type distribution transformers and it takes the value of 0.50 for liquid-filled distribution transformers. The default is 0.35.	numeric	/
	Availability Schedule	Contains the schedule name (ref. Schedule objects) that contains information on the availability of the transformer. A schedule value greater than 0 (usually 1 is used) indicates that the transformer is available to convert AC power from one voltage to another. A value less than or equal to 0 (usually 0 is used) denotes that the transformer is not available. If this field is blank, the schedule has values of 1 for all time periods.	text	/
	Phasing			
	Phase	Identifies the phase in which the object is created.	text	/
Documentation:				
Set of documents:	Occupancy and Usage Schedules			

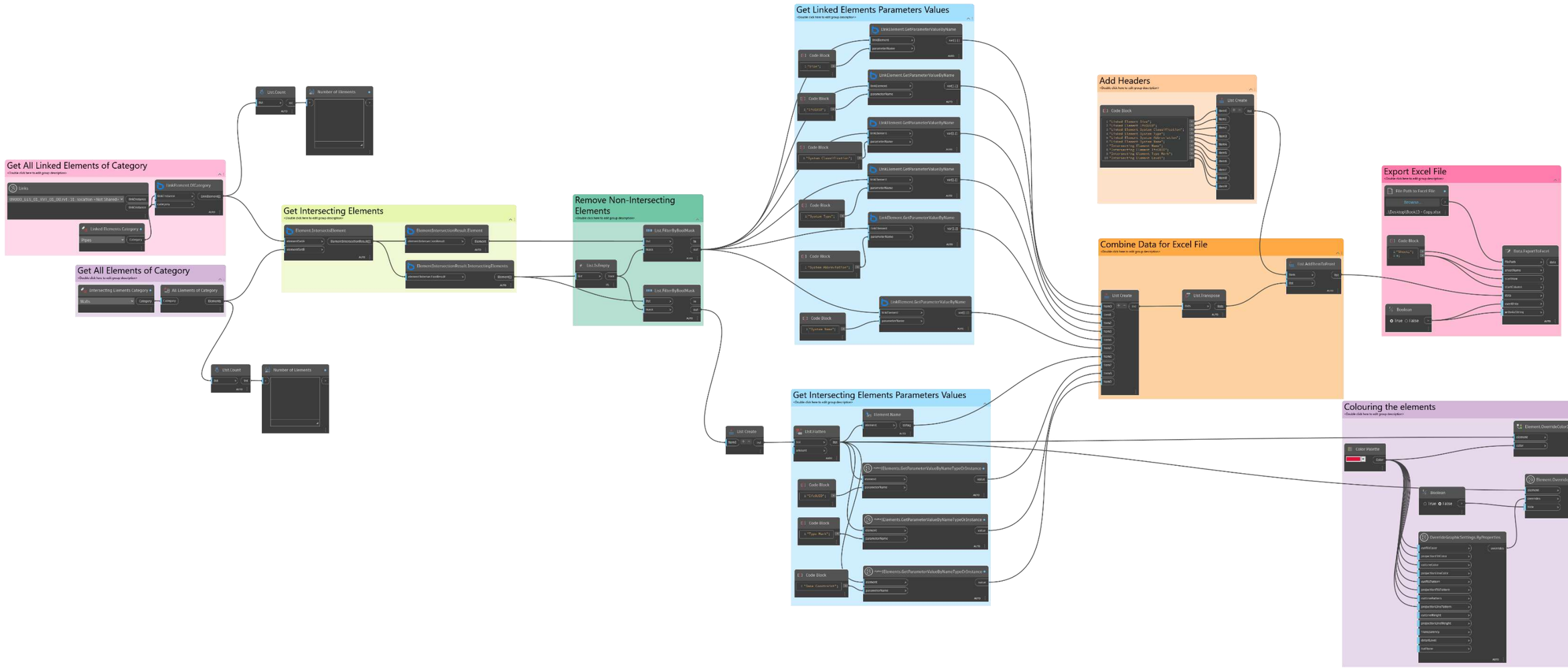
APPENDIX 8: DYNAMO SCRIPT: UNIQUE ROOM NAMING



APPENDIX 9: DYNAMO SCRIPT – UNALLOCATED / UNPLACED ROOMS



APPENDIX 10: DYNAMO SCRIPT – INTERSECTING ELEMENTS



APPENDIX 11: IFCOPENSHELL SCRIPT: MINIMAL HANDRAIL HEIGHT

```python
import ifcopenshell

# Open the IFC file
ifc_file_path = '05.ifc'
ifc_file = ifcopenshell.open(r'C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.RailingHeight\05.ifc')

railings = ifc_file.by_type("IfcRailing")

def get_property_value(ifc_object, property_name):
    prop_value = None
    for property_set in ifc_object.IsDefinedBy:
        if property_set.is_a("IfcRelDefinesByProperties"):
            if property_set.RelatingPropertyDefinition.is_a("IfcPropertySet") and \
                    property_set.RelatingPropertyDefinition.Name == "Pset_RailingCommon":
                prop_value = next((prop.NominalValue.wrappedValue for prop in
 property_set.RelatingPropertyDefinition.HasProperties if prop.Name == property_name), None)
    return prop_value

total_railings = len(railings)
railings_not_meeting_requirement = 0

for railing in railings:
    height = get_property_value(railing, "Height")
    if height is not None and height < 0.9:
        name = railing.Name if hasattr(railing, "Name") else "N/A"
        guid = railing.GlobalId
        print(f"Railing Name: {name} | Railing GUID: {guid} | Height does not meet requirement ({height}m)")
        railings_not_meeting_requirement += 1

print(f"Total Railings: {total_railings}")
print(f"Railings Not Meeting Requirement: {railings_not_meeting_requirement}")

```

APPENDIX 12: IFCOPENSHELL SCRIPT: ROOM AREA

```python
import ifcopenshell
import ifcopenshell.geom
from trimesh import Trimesh
import openpyxl
import pandas as pd

# Set up IFC file and settings
settings = ifcopenshell.geom.settings()
ifc_file = ifcopenshell.open(r'C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.Room Schedule\05.ifc')
spaces = ifc_file.by_type('IfcSpace')

# Read Excel file
excel_file = r'C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.Room Schedule\Room Schedule.xlsx'
data = pd.read_excel(excel_file)
excel_areas = dict(zip(data['Room Number'], data['Room Area']))

# Initialize counters
pass_count = 0
fail_count = 0

# Create a Trimesh for each space and calculate its area, then compare with Excel data
for space in spaces:
    shape = ifcopenshell.geom.create_shape(settings, space)
    faces = shape.geometry.faces
    verts = shape.geometry.verts
    grouped_verts = [[verts[i], verts[i + 1], verts[i + 2]] for i in range(0, len(verts), 3)]
    grouped_faces = [[faces[i], faces[i + 1], faces[i + 2]] for i in range(0, len(faces), 3)]
    mesh = Trimesh(grouped_verts, grouped_faces)

    area = round(mesh.section([0, 0, 1], mesh.centroid).to_planar()[0].area, 2)  # Round to 2 decimal places
    name = space.Name
    long_name = space.LongName
    room_number = name  # Assuming room number is the same as the space name

    excel_area = excel_areas.get(room_number)

    if excel_area is not None:
        if area == excel_area:
            print(f"Room Area Pass: {name}, {long_name}, Room Number: {room_number}, Area: {area} m²")
            pass_count += 1
        else:
            print(f"Room Area Fail: {name}, {long_name}, Room Number: {room_number}, "
                  f"Area in IFC: {area} m², Area in Excel: {excel_area} m²")
            fail_count += 1
    else:
        print(f"Room Area Fail: {name}, {long_name}, Room Number: {room_number}, "
              f"Area in IFC: {area} m², No matching Room Number in Excel")
        fail_count += 1

# Print pass and fail counts
print(f"Pass Count: {pass_count}")
print(f"Fail Count: {fail_count}")
```

APPENDIX 13: IFCOPENSHELL SCRIPT: ELEMENTS LOCATION – DOORS/WINDOWS

```python
import ifcopenshell
import ifcopenshell.util.element

# Open the IFC file
ifc_file_path = '05.ifc'
ifc_file = ifcopenshell.open(r'C:\Users\adjuk\Desktop\Case Studies\IfcOpenShell.Levels\05.ifc')

# Initialize counters
total_doors = 0
total_windows = 0
failures = 0

# Find doors and windows associated with a wall through IfcRelVoidsElement and IfcRelFillsElement relationships
def find_doors_and_windows(wall):
    doors = []
    windows = []

    # Find IfcRelVoidsElement relationships
    void_relations = ifc_file.by_type("IfcRelVoidsElement")
    for rel in void_relations:
        if rel.RelatingBuildingElement == wall:
            opening = rel.RelatedOpeningElement
            if opening.is_a("IfcOpeningElement"):
                # Find IfcRelFillsElement relationships for the opening
                fill_relations = ifc_file.by_type("IfcRelFillsElement")
                for fill_rel in fill_relations:
                    if fill_rel.RelatingOpeningElement == opening:
                        filling = fill_rel.RelatedBuildingElement
                        if filling.is_a("IfcDoor"):
                            doors.append(filling)
                        elif filling.is_a("IfcWindow"):
                            windows.append(filling)

    return doors, windows

# Get all IfcWall elements from the IFC file
walls = ifc_file.by_type('IfcWall')

# Loop through each wall
for wall in walls:
    # Find doors and windows associated with the wall
    wall_doors, wall_windows = find_doors_and_windows(wall)

    # Check if the wall has doors or windows
    if wall_doors:
        total_doors += len(wall_doors)

        # Find the spatial container (building storey) for the wall
        container = ifcopenshell.util.element.get_container(wall)
        wall_level = container.Name if container else "Unknown Level"

        for door in wall_doors:
            door_level = ifcopenshell.util.element.get_container(door)
            door_level_name = door_level.Name if door_level else "Unknown Level"
            if door_level_name != wall_level:
                failures += 1
                print("Fail: Door level does not match wall level.")
                print("Wall Name:", wall.Name)
                print("Wall GUID:", wall.GlobalId)
                print("Wall Level:", wall_level)
                print("Door Name:", door.Name, "| Door Level:", door_level_name, "| Door GUID:", door.GlobalId)
                print("---")

    if wall_windows:
        total_windows += len(wall_windows)

        # Find the spatial container (building storey) for the wall
        container = ifcopenshell.util.element.get_container(wall)
        wall_level = container.Name if container else "Unknown Level"

        for window in wall_windows:
            window_level = ifcopenshell.util.element.get_container(window)
            window_level_name = window_level.Name if window_level else "Unknown Level"
            if window_level_name != wall_level:
                failures += 1
                print("Fail: Window level does not match wall level.")
                print("Wall:", wall.Name)
                print("GUID:", wall.GlobalId)
                print("Wall Level:", wall_level)
                print("Window:", window.Name, "| Window Level:", window_level_name, "| Window GUID:", window.GlobalId)
                print("---")

# Print summary
print("Total Doors:", total_doors)
print("Total Windows:", total_windows)
print("Total Failures:", failures)
```