Building Information Modelling (BIM) Guide for Building Services Installation

(Version 3.1)

Building Services Branch
Architectural Services Department

Objective

The primary purpose of this Guide is to gather and present factual materials in such a manner that project officers, both professional and technical, could obtain a common reference of the various practices on the adoption of BIM in design and construction for building services installations in building projects undertaken by the Building Services Branch of the Architectural Services Department.

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1. Introduction

1.1 Overview

This Building Information Modelling (BIM) Guide for Building Services Installation (hereinafter as the "Guide") documented the general requirements in the management and production of BIM models and related requirements for new works projects managed by Architectural Services Department (ArchSD). It aims at providing the basic requirements and practices for the processing of BIM model and related deliverables at design, construction and handover stages as reference. The Guide is formulated base on local and international recognized BIM standards, guidelines and industry practices. BIM is still under rapid development and this Guide would be subject to regular review and update to suit the latest development on BIM.

1.2 Reference BIM Standards and Guidelines

This Guide has made reference to the following international and local standards and guidelines:-

(a) Development Bureau Technical Circular (Works) No. 02/2021 - Adoption of Building Information Modelling for Capital Works Projects in Hong Kong;
(b) Development Bureau Technical Circular (Works) No. 08/2021 – Building Information Modelling Harmonisation Guidelines for Capital Works Projects in Hong Kong;
(c) BIM Harmonisation Guidelines for Works Departments (Version 2.0 – May 2023) by the Development Bureau;
(d) CIC BIM Standards – General (Version 2.1 - 2021) issued by Hong Kong Construction Industry Council;
(e) CIC BIM Standards for Mechanical, Electrical and Plumbing (Version 2 - 2021) issued by Hong Kong Construction Industry Council;
(f) CIC BIM Standards for Preparation of Statutory Plan Submissions (December 2020) issued by Hong Kong Construction Industry Council;
(g) CIC BIM Guide for using BIM in generation of MEP digital drawings for statutory submissions (2021) issued by Hong Kong Construction Industry Council;
(h) CIC Production of BIM Object Guide – General Requirements (Version 2 - 2021) issued by Hong Kong Construction Industry Council;
(i) CIC BIM Dictionary (2021) issued by Hong Kong Construction Industry Council;
(j) Computer-Aided-Drafting Standard for Works Projects (CSWP) issued by Development Bureau of the HKSAR Government;
(k) American Institute of Architects (AIA)'s G202-2013 Building Information Modeling Protocol Form.
(l) BS EN ISO 19650-1:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling Part 1: Concepts and Principles;
(m) BS EN ISO 19650-2:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling Part 2: Delivery Phase of the Assets;
(n) BS EN ISO 19650-3:2020 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling, Part 3: Operational phase of the assets;

(o) BS EN ISO 19650-5:2020 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling, Part 5: Security-minded approach to information management;
(p) PAS 1192-3:2014 Specification for information management for the operational phase of assets using Building Information Modelling;
(q) PAS 1192-5:2015: Specification for security-minded Building Information Modelling, digital built environments and smart asset management;
(r) Building Information Modelling – Asset Management (BIM-AM) Standards and Guidelines issued by Electrical and Mechanical Services Department (EMSD);
(s) BIM Guide for Facilities Upkeep issued by Property Services Branch of the Architectural Services Department; and
(t) BIM Guide for Cost Estimation issued by Quantity Surveying Branch of the Architectural Services Department.

1.3 Abbreviation and Terminology

The abbreviations and terminology/glossary as stated in the CIC BIM Dictionary (2021) applies.

2. Data Management Requirements

2.1 General

Prior to BIM model production, a unified data management structure should be established for efficient BIM collaboration and information exchange in Common Data Environment (CDE). The project setup framework should make reference to ISO19650. A project folder setup should be developed for individual project by the project team according to the agreed/approved BIM Execution Plan (BEP).

2.2 Project Folder Structure

Project folder structures for BIM operation in the design and construction stage are recommended as follows:

Folder Structure	Description
[Project Name/Code/Identity, e.g. InForM no.]	
01 General	Folder to share general information such as contact list, project information, templates, title block, reference materials, etc.
02 WIP	
10 Architectural	Folders to store work in progress (WIP) models /information being developed by individual discipline teams for internal collaboration. Usually the access is restricted to the individual discipline teams.
20 Building Services	
30 Structural	
40 Landscape Architecture	
50 Quantity Surveying	
60 Project Management	
03 Shared	
10 Architectural	Folders to share approved models/information by individual discipline team for collaboration. Only current models/information should be stored and outdated/obsolete files should be moved to the "05 Archive" folder.
20 Building Services	
30 Structural	
40 Landscape Architecture	
50 Quantity Surveying	
60 Project Management	
04 Published	
10 Architectural	Folders to share authorized models/information for publishing at milestones (usually in non-editable format) where they are ready for submission, procurement and construction (e.g. GBP, Tender DWG, etc.).
20 Building Services	
30 Structural	
40 Landscape Architecture	
50 Quantity Surveying	

Folder Structure	Description
60 Project Management	
05 Archive	
10 Architectural	Folders to store historical records of file transaction such as previously shared /published models which were outdated.
20 Building Services	
30 Structural	
40 Landscape Architecture	
50 Quantity Surveying	
60 Project Management	
06 As-built	
10 Admin	Folders to store as-built models/information with structure referenced to BIM Guide for Facilities Upkeep.
20 BIM Library	
30 As-built BIM	
40 O&M Documentation	
50 Photo	
60 Drawing Sheet	
70 Inspection	
80 Statutory	
90 Others	

2.3 Model Division

A project BIM model should normally be divided into separate services/systems (e.g. air-conditioning, electrical, fire services, plumbing, drainage, etc.). For projects with large site footprint where several building blocks existed, the model may be further divided into several zones (building blocks) for more efficient handling of models. For example:

For project with a single building block:

Model Name	Building	Category
7781-ADB-XX-ZZ-BS_HA-M3_N.xxx	Government Offices	MVAC Installation
7781-ADB-XX-ZZ-BS_EL-M3_N.xxx	Government Offices	Electrical Installation
7781-ADB-XX-ZZ-BS_FS-M3_N.xxx	Government Offices	Fire Services Installation

For project with 3 separated building blocks in the same site:

Model Name	Building	Category
8184-ADB-XX-OF-BS_HA-M3_N.xxx	Offices Block	MVAC Installation
8184-ADB-XX-TL-BS_FS-M3_N.xxx	Toilet Block	Fire Services Installation
8184-ADB-XX-AC-BS_EL-M3_N.xxx	Ancillary Block	Electrical Installation

The BEP shall state the model division strategy (by services/systems or building blocks, etc.). File sizes of each divided BIM model shall be kept minimum by purging of unused views, BIM objects and settings before publish or submission. In general, the file size for each divided BIM model is preferably controlled under 500Mb unless otherwise agreed by the Employer. The modelling practices for all divided BIM models shall be consistent so that they could be combined into federated model together with models of other disciplines in common software platform tools.

2.4 Information Exchange Formats

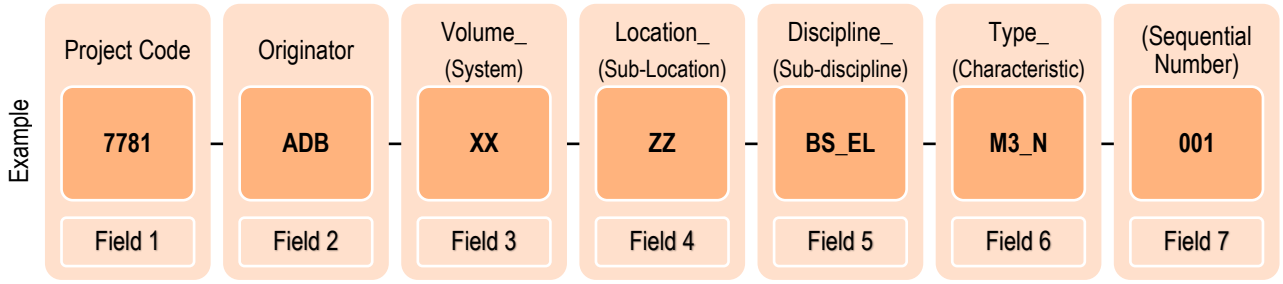
To enable interoperability, exchange formats such as IFC shall be adopted to facilitate geospatial and non-geospatial information exchange. The information exchanges requirement should refer to the BIM Guide for Facilities Upkeep issued by the ArchSD and the BIM-AM Standards and Guidelines issued by EMSD. For example, the information exchange of asset data for EMSD BIM-AM is by means of COBieLite.

2.5 General Naming Convention

(a) Use only letters A-Z, hyphen, underscore and numbers 0-9 for all fields;
(b) All fields shall be separated by a hyphen character “-“. DO NOT use spaces;
(c) Within a field, either Camel Case or an underscore “_” shall be used instead of a space to separate words;
(d) A single period character "." shall be used to separate the file name from the extension. This character should not be used anywhere else in the file name;
(e) The file extension shall not be amended or deleted;
(f) The scheme for zone and level sub-division shall be agreed with the other project professionals at the outset and defined in the BIM Project Execution Plan (BEP);and
(g) Elements where a naming convention is not explicitly defined by this Standard shall adopt the naming convention of existing elements and prefix with a 3-character abbreviation to identify corporate author (e.g use ADB to identify ArchSD Building Services Branch).

2.6 Model File Naming

The model file naming convention should follow the Hong Kong Local Annex of ISO 19650-2:2018 in Annex 1 of the CIC BIM Standards General and BIM Harmonisation Guidelines for Works Departments (Version 2.0 – May 2023) by the Development Bureau as follows:-



(Optional Sub-Field): Supplement or adopt according to Project setting.

Field	Description and Format	
Field 1 (4-8 characters)	**Project Code** A unique identifier for identification of the project: InForM or contract number (e.g. 7781)	
Field 2 (3 characters)	**Originator** A unique identifier based on Agent Responsible Code (ARC) of the CAD Standard for Works Projects to indicate the model's responsible authoring party: "ADB" for building services discipline of ArchSD	
Field 3 (2-6 characters excluding underscore "_")	**Volume (2-3 characters)** A unique identifier to indicate specific geospatial zone or volume of the project (if required). The following generic codes should apply: **"ZZ"** – all volumes/systems **"XX"** – division of volume/system is not required.	**(System) (2-3 characters)** An optional identifier to indicate a collection of interconnected model elements across main disciplines under a system (if required)
Field 4 (2-6 characters excluding underscore "_")	**Location (2-4 characters)** A unique identifier to indicate specific location for geospatial coordination. The following generic codes should apply: **"ZZ"** – multiple levels/locations; and **"XX"** – no levels/location applicable.	**(Sub-location) (2 characters)** An optional identifier to indicate a sub-location (e.g. level) within the same location.
Field 5 (2-4 characters excluding underscore "_")	**Discipline (2 characters)** An identifier for each primary discipline to facilitate appearance settings and information filtering for interdepartmental coordination. The standard code **"BS"** should be applied.	**(Sub-discipline) (2 characters)** An optional identifier to indicate the sub-discipline (trade). The coding should refer to EMSD's BIM Standards and Guidelines. If it is a model combined multiple disciplines, "**ZZ**" should be used.
Field 6 (2-3 characters excluding underscore "_")	**Type (2 characters)** An identifier to indicate the information held within the container. Commonly used type identifier as follows: **CM** – combined model **DR** – 2D drawing **M3** – 3D model	**(Characteristic) (1 character)** An optional identifier to indicate the model's characteristic. Commonly used codes as follows: **E** – Existing **T** – Temporary works **N** – New works **A** – As-built

Field	Description and Format	
		M – Maintenance **D** – Demolition **W** – All Works of above
Field 7 (3 characters)	**Sequential Number (3 characters)** An optional identifier to be assigned when it is necessary to further distinguish the model from the others.	

For a delimiter between Main Fields the Hyphen (-) or Minus character using Unicode Reference U+002D shall be used. Where a delimiter is required between Main Fields and Sub-Fields (if Sub-Field is required), then the Underscore (_) character using Unicode reference U+0332 shall be used.

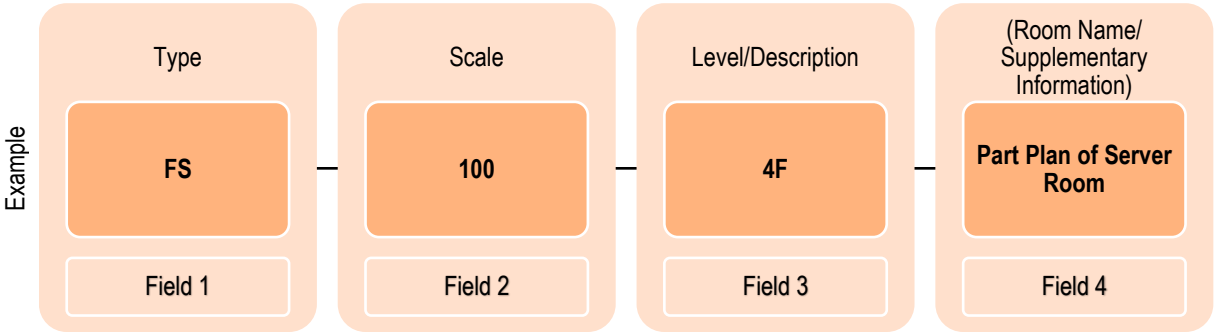
The maximum total length of model names is 43 characters, including delimiters and information dividers but excluding file extension.

The following table provides some examples of BIM model file naming:-

Description	**Model File Name**
Project InForM number: *7781*; Originator: *ArchSD-Building Services*; Volume: *not applicable*; Location: *Non-specific location*; Discipline: *Building Services discipline*; Type/Characteristic: *3D BIM model of new works project*. ; Sequential number is not required.	7781-ADB-XX-ZZ-BS_EL-M3_N.xxx
Project InForM number: *7781*; Originator: *ArchSD-Building Services*; Volume: *not applicable*; Location: *Management Office Building*; Discipline: *Building Services discipline*; Type/Characteristic: *3D BIM model of as-built nature*. Sequential number is not required.	7781-ADB-XX-MB-BS_DR-M3_A.xxx

Remark: ".xxx" – file name extension

2.7 View Naming



(Optional Field): Supplement or adopt according to Project setting.

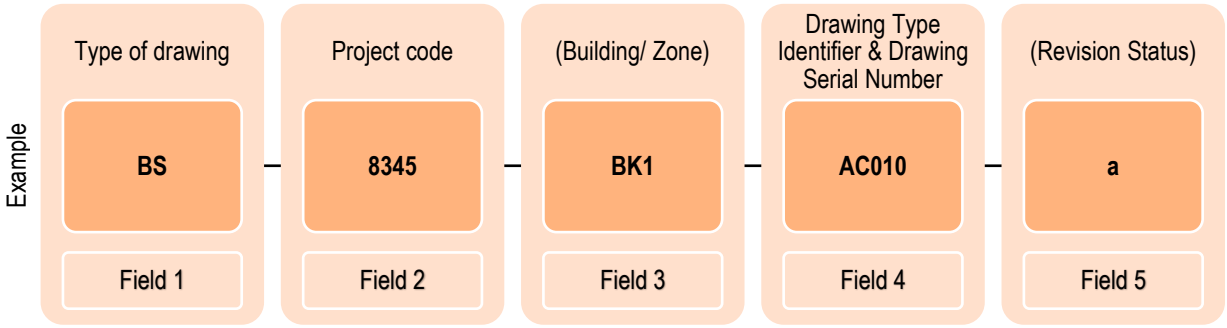
Field	Description and Format
Field 1 (2-4 characters)	**Identifier** Commonly used type identifier as follows: AC – Air conditioning and ventilation LT – Lighting SY – Security FS – Fire Services ME – Mechanical Plant TG – Town Gas EM – Miscellaneous E&M Equipment GO – Gondola LF – Lift and Escalator SP – Swimming Pool SD – Drainage SCCU – SCCU Submission DSD – DSD Submission HKE – HKE Submission EE – Electrical ELV – Extra Low Voltage GE – Generator WS – Water supply MG – Medical Gas CR – Cremator FE – Fountain Equipment HW – Hot Water/ Boiler PU – Pump ST – Sewage Treatment Plant WSD – WSD Submission FSD – FSD Submission CLP – CLP Submission More identifiers are as shown in Sections 3.2 of CAD Manual for Architectural Services Departmental Projects.
Field 2 (4 characters)	**Scale** For example 50 for 1:50; 100 for 1:100 and 2000 for 1:2000 etc.
Field 3	**Level/Description** GF, 1F, 2F, RF, Site Plan, Elevation, Section, etc.
Field 4 **(if applicable)**	**(Supplementary information)** e.g. Part 1 of 4, Part Plan of A/C Plant Room, etc.

The following table provides some examples of view naming:-

Description	View Name
1:100 Lighting Layout of 1/F	LT-100-1F
1:100 Fire Services Layout of 4/F, Part Plan of Server Room	FS-100-4F-Part Plan of Server Room
1:100 Drainage Layout of Site Plan, Part 1 of 2	SD-100-Site Plan-Part 1 of 2
1:100 Site Plan for SCCU Submission, Part 1 of 2	SCCU-100-Site Plan-Part 1 of 2
1:100 Site Plan for DSD Submission, Part 1 of 2	DSD-100-Site Plan-Part 1 of 2

2.8 Drawing Number Naming

Drawing number on the drawing generated from BIM model should refer to Sections 4.1 of CAD Manual for Architectural Services Departmental Projects.



(Optional Field): Supplement or adopt according to Project setting.

Field	Description and Format
Field 1 (2 characters)	**Type of Drawing** **BS** – Buiding Services drawing
Field 2 (4-5 characters - numeric)	**Project Code** A unique identifier for identification of the project: InForM (e.g. 7781)
(Field 3) (5 characters)	**(Building/Zone)** A project may consist of more than one building or one site. To identify different buildings of the same project, an optional field for building number is devised. This will be a serial number of maximum 5 numeric, or 2 alphas + 3 numeric, or 3 numeric + 2 alphas. The alphas shall be upper case letters. The identification for the field will be controlled by the corresponding Project Team Leader.
Field 4 (5 characters -2 alphas + 3 numeric)	**Drawing Type Identifier & Drawing Serial Number** This field indicates the type of drawings and the number of drawings issued. The first two alphas are used to identify the type of drawings (refer Section 3.2 of the CAD Manual for ArchSD Projects for the lists of the identifiers for building services drawings). The remaining 3 numeric digits serve to indicate sequence of the drawing numbers.
Field 5 (1-2 characters)	**Revision Status** This field applies only when there are revisions to the drawing. Alpha (lower case letter) such as 'a', 'b', 'c', 'd', 'e', etc. is used to signify the changes/amendments as a suffix to the entire drawing number.

The following table provides some examples of drawing number naming:-

Drawing Name	Drawing Number
Electrical layout	BS/4235/EE002
Air Conditioning and Ventilation Plan	BS/8345/AC010a
Fire Services Plan	BS/8345/FS010

3. BIM Uses

3.1 General

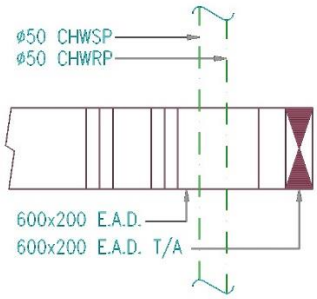
The scope of BIM Uses in public works projects shall be according to the latest BIM related Technical Circular (Works) issued by the Development Bureau (DEVB). The following sections describe the general requirements and acceptable deliverables for various BIM Uses for building services installation.

3.2 Design Authoring

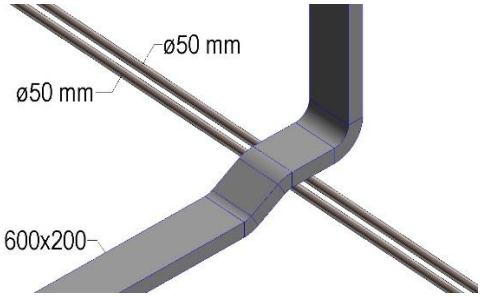
Design Authoring is a process of design starting from the outset by using BIM software platform. Project team shall use BIM software to create and develop a project BIM model. Plan,such as, section, and schedule, etc, will be produced by the authoring tools as far as practicable.

Unlike traditional design process using 2D software tool, the spatial coordination among services and other disciplines could perform efficiently by using BIM design software tool. The following graphs show the example on the design coordination between an air duct and chilled water pipes.

Traditional design authoring using 2D software tool



BIM design authoring with coordination among services from the outset



Unlike other disciplines, the design of building services installation usually originates from the schematic / logical diagram prior to the geospatial design. For example, the designer would first outline the electrical power distribution schematic diagram before working on the power distribution routings. Since the market available BIM software tools may not be capable to link up schematic and spatial design, it is understandable that a hybrid environment, i.e. use of 2D design tools to outline the schematic design and use of BIM software to exercise 3D spatial design, would still be maintained.

3.3 Design Review

Design Review is a process for stakeholders to view BIM model, images from the models or animated walk-throughs of the design, provide feedback and validate design aspects such as meeting design /specification requirements and previewing spaces/layouts in 3D geometry.

Examples of the process are as follows:

(a) Regular workshop or meeting to review the federated BIM design model by project team in design stage using BIM software platform;
(b) Regular workshop or meeting to review the federated BIM construction model by project team before construction/installation of equipment in construction stage using BIM software platform; and
(c) Virtual mock-ups for review and approval by project team or client.

There are numerous ways for carrying out design review process. Some examples are animated walk-throughs in BIM software platform, virtual mock-up by BIM software platform and virtual mock-up by using virtual reality technology, etc. where project team may consider to plan and specify if appropriate.

3.4 Existing Conditions Modelling

It is a process of 3D digital survey and production of BIM model for an existing site to facilitate design planning. The digital survey may be carried out by photogrammetry or laser scanning technology to generate Point Cloud model which is later transformed to an editable BIM model. The deliverables should at least include BIM model(s) indicating the existing building services, architectural and structure elements as appropriate. Where specified, the 3D digital survey model should meet the following requirements:

(a) Georeferenced to the absolute coordinate system;
(b) Referenced and generated from the digital Point Cloud survey result;
(c) With colour schemes applied to various building services, architectural and structure elements for differentiation; and
(d) Capable to serve as a base model for next step design authoring use.

3.5 Site Analysis

It is a process in which BIM and Geospatial Information System (GIS) tools are used to evaluate a site to determine the most suitable location, position and orientation for a future project. The analysis shall include master planning, sun and shadow studies, daylight analysis and solar envelope analysis. This is normally performed by the architect or surveyor of a project and is only required if specified in project.

3.6 3D Coordination

It is a process of using clash detection software tools to identify conflicts by analyzing 3D design models from time to time during the design authoring process. The goal of the coordination process is to deliver a proper design in design/pre-construction stage where the design/pre-construction scheme should be clash-free. It is an on-going process starting from the outset of design by various disciplines of design professionals. The following deliverables should be provided in design and construction stage as a minimum:

(a) Clash analysis reports for the combined building services model for individual zones/floors;
(b) Action plan with target completion schedule to handle and eliminate detected clashes by designer/design consultants; and
(c) The clash analysis shall include the checking of headroom requirements and working spaces for building services operations and maintenance activities.

3.7 Cost Estimation

It is a process of quantity take-offs directly from the BIM model to assist for cost estimation exercise for a project. For example, the use of BIM model to assist for counting the number of major equipment (e.g. AHU) for the project. This is normally performed by quantity surveyor.

3.8 Engineering Analysis

It is a process to analyze and assess different design options to determine the most effective engineering solution by using BIM modelling or associated software. Application examples includes lighting performance analysis, computational fluid dynamic (CFD) analysis, energy analysis, etc.

The following deliverables should be provided in design and construction stage as minimum:

(a) Lighting performance simulation using the BIM model with outputs of 3D visualized effect and performance results for at least 3 selected areas/room types; and
(b) Energy modelling study

3.9 Facility Energy Analysis

It is a process to analyze and assess the building energy performance by using building energy simulation software with the aid of BIM model.

3.10 Sustainability Evaluation

For projects which aim to obtain the Gold or above rating of “BEAM Plus NB 2.0” certification of the Hong Kong Green Building Council (HKGBC), the credit(s) for “BIM Integration” shall be attained.

3.11 Space Programming

It is a process in which a spatial program is used to efficiently and accurately assess a design layout model in regard to client spatial requirements. This is normally performed by architect and is only required if specified in project.

3.12 Phase Planning (4D Modelling)

It is a process of linking a construction work programme to the model which is used to show the construction sequence and phasing for construction. The process is usually name as 4D modelling. The following deliverables should be provided in design and construction stage as a minimum:-

(a) On top of the overall building construction 4D work sequence model, specific 4D simulation report for the following major building services plants to demonstrate the proper delivery, installation, dismantle and replacement should be provided:
    - Central air-conditioning chilled water plant with total cooling capacity exceed 10,000kW; and

- Central steam plant with total steam capacity exceed 2 ton/hour.

(b) The 4D simulation report shall contains the description of assumption, time interval, construction method statement, guide for accessing the files and models, video(s) of the 4D simulation, BIM native model(s), model(s) for the 4D simulation platform and linked overall project programme;

(c) The 4D work sequence model shall link up the construction master programme to demonstrate the compatibility of the installation works sequences of the BS/E&M plant; and

(d) The model shall be assigned with the delivery path of major building services equipment to demonstrate the feasibility and effectiveness of the installation method statements of the works. All temporary works and site logistic arrangement shall be modelled to demonstrate the feasibility and prove the constructability and buildability of the proposed method statement.

3.13 Digital Fabrication

It is a process to use BIM models to facilitate the fabrication of construction materials or assemblies such as sheet metal fabrication, structural steel fabrication and pipe cutting. The models can also be used for prototyping with 3D printers as part of a design intent review process.

3.14 Site Utilization Planning

It is a process to use BIM models to perform site space planning, site logistics, sequencing requirements, temporary works and safety. If specified, the construction phase BIM model should be linked to the construction schedule (4D) include permanent and temporary facilities on site for all of the phases of the construction process. This is normally performed by the contractor if specified in the contract.

3.15 3D Control and Planning

It is applicable for project requiring the adoption of Digital Works Supervision System in according to DEVB Technical Circular (Works) No.2/2023 that digital setting-out, construction checking, etc. as appropriate by means of 3D laser scanners, robotic total stations, etc. shall be adopted as far as practicable.

3.16 As-built Modelling

It is a process of preparing an accurate record of the physical conditions and assets of a project. The as-built model should contain information relating to the building services elements with links to operation, maintenance, and asset data. Additional information and data for equipment and space planning may be included. The following deliverables should be provided for as-built BIM model:

(a) 3D textured digital model created by photogrammetry and laser scanning technology for accurate geometric and photogrammetric detail for the following completed works;
- Central air-conditioning chilled water plant with total cooling capacity exceed 10,000kW; and
- Central steam plant with total steam capacity exceed 2 ton/hour.

(b) Browsing software/software license (during DLP) for the 3D textual digital model;

(c) As-built BIM model(s) with required equipment/materials information embedded; and

(d) File folder contains the as-built model(s) and other necessary information, files and documents as required for asset management (refer to other section of this Guide).

3.17 Project Systems Analysis

It is a process to measure how a project performs compared to the design specifications. This may include assessing how a mechanical system operates, how much energy a project uses, conducting lighting analysis, solar gain analysis and airflow analysis using CFD.

3.18 Maintenance Scheduling

It is a process for planning and managing the maintenance of a project structure, building fabric and equipment during the operational life of a facility. The data required for asset management should be collected during the construction stages and input into the as-built BIM model.

3.19 Space Management and Tracking

It is a process to utilize as-built BIM model to assess, manage and track spaces and associated resources within a project. A BIM database may be integrated with spatial tracking software to analyze the existing use of space, apply transition planning for renovations and refurbishment projects.

3.20 Asset Management

It is a process of identifying the required data sets and data formats which can be extracted from as-built BIM models for the maintenance agencies' use. In general, the requirements are stipulated in the EMSD's BIM-AM Standards and Guidelines.

3.21 Drawing Generation (Drawing Production)

It is a process of producing drawing sheets from the BIM model source. For some building services equipment, the direct presentation of their geometry shape in 2D view may not be legible or identifiable on its function. The use of symbols with proper offset are required for clear presentation when generate the 3D geometry model to 2D drawing sheet.

For schematic and control logic diagrams as supplement of design details of building services designs, the use of 2D design authoring tools to produce the drawings are acceptable.2D drawings which are generated from the BIM model need not to follow CSWP.

4. Modelling Requirements

4.1 Coordinate System

The orientation of a BIM model shall be defined and coordinated with all disciplines as follows when the project is located in Hong Kong:-

(a) Easting and Northing shall refer to Hong Kong 1980 Grid System (HK1980 Grid); and
(b) Elevation shall refer to the Hong Kong Principal Datum (HKPD).

If a model is produced in a local coordinate system due to software functionality or limitations, the BIM coordinator or modeller shall be responsible for providing clear instruction and documentation as to the origin x, y, z and bearing translations accompanying their BIM submission. Software specific setting on coordinate system should be defined in BEP.

Where Project North is created, it should only be used for identified sheet view and not used for any model coordination.

4.2 Linking to Architectural, Landscape or Structure Models

The general rules for model linking are as follows:

(a) The coordinates of the architectural, landscape and/or structure models should be checked before linking. Same coordinates should be adopted for models to be linked;
(b) Models to be linked should be purged before linking;
(c) Do not link to model under working (WIP); and
(d) The linked model should not be a copy of the central model.

4.3 Unit of Measurement

BIM model should be modelled in metric system (International System of Units or SI Units). Project Units should be set as below:

Measurement	Units
Length	mm
Area	m^2 in 3 decimal places
Volume	m^3 in 3 decimal places

4.4 Date Format

Date format should follow ISO 8601 Data elements and interchange formats – Information interchange – Representation of dates and times as follow:

Year				Month		Date	
Y	Y	Y	Y	M	M	D	D

4.5 Scope of Modelling

The BIM model should cover the entire building services installation for the whole project development if associated architectural model is available. In general, components not embedded into concrete or building structure should be model. As a general reference, the building services objects/elements listed in Annex A – Modelling Scope and LOIN Requirements should be modelled if applicable to the projects. The list in Annex A is not exhaustive and additional objects/elements specific to individual projects should be included and documented in the BEP.

4.6 Level of Information Need (LOIN)

The recommended LOD-G and LOD-I for individual building services element at different stages are listed in Annex A. The definitions and requirements of graphical representation (LOD-G), non-graphical information (LOD-I) and documentation (DOC) of MEP elements should make reference to the CIC's BIM Standards (General) and BIM Standards for Mechanical Electrical and Plumbing (MEP).

4.7 Level of Graphics (LOD-G)

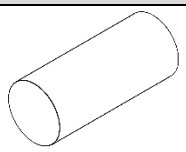
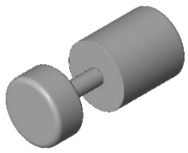
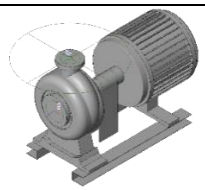
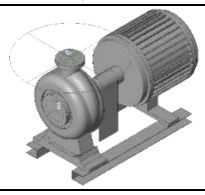
The definitions of various levels of the LOD-G for building services installation are as listed in the following table.

Definition of LOD-G

LOD-G	Definition
100	The model element is graphically represented within the model by a symbol or generic representation or rough 3D shape.
200	The model element is graphically represented within the model as a **generic** system, object or assembly with approximate quantities, size, shape, location and orientation. The general required spaces for access and maintenance shall be indicated. Model element is graphically represented as assumed size/shape of equipment
300	The model element is graphically represented within the model as a **specific** system, object or assembly in terms of quantity, size, shape, location and orientation. The model/object shall include details of the spaces required for handling installation, operation and maintenance, and the interface details for checking and coordination with other models/objects. The model element should easily be recognized the graphical representation without further clarification.
400	The model element is graphically represented within the model as a **specific** system, object or assembly in terms of quantity, size, shape, location and orientation with detailing, fabrication, assembly and installation information.

Examples of the object graphical representations for a water pump set at different levels of LOD-G are illustrate in following table.

Example of Object Graphical Representation for a Water Pump Set

LOD-G	Example Image	Description
100		**Schematic Model** The water pump set is modelled to indicate its existence for scheme design purpose
200		**Generic Model** A generic water pump set in which the approximate quantities, size, shape, location and orientation are not specific
300		**Specific Model** A specific water pump set in which the quantity, size, shape, location and orientation are specific for individual design application area
400		**Specific Model with Fabrication Details** A specific water pump set in which the manufacturer size, dimensions and details are specific for fabrication purpose

4.8 Level of Information (LOD-I)

LOD-I is the description of non-graphical information of a MEP model element. The information required for the model elements will be enriched as a project progresses and evolves. The minimum data requirements at various levels of LOD-I for building services installation are as following table.

Minimum Data Requirements of LOD-Graphics (LOD-G)

BIM Object Properties	Object Data Requirements	LOD-I				
		100	200	300	400	500
General Properties	General information of the object including equipment identification, designation, type, materials, etc.	R	R	R	R	R
Design Properties	Design information and parameters of the objects.		R	R	R	R
Classification Properties	The classification title and code of the model elements reference to the OmniClass table 23 or other coding system as agreed			R	R	R
Manufacturer's Equipment Properties	Manufacturer's equipment information and parameters of the objects, including equipment manufacturer's name, supplier's name, brand name, model number and country of origin				R	R

Condition Properties	Installation information including installation month/year, latest testing /commissioning month/year and equipment life expectancy				R	R
Verification Properties	Field verification method used for verifying the as-built element					R

Remark: R – Required

Examples of the object data requirements for an air-cooled chiller at different levels of LOD-I are illustrate in following table.

Example of Object Data Requirements for an Air-cooled Chiller

BIM Object Properties	Object Data Requirements	LOD-I				
		100	200	300	400	500
General Properties	Equipment type : air-cooled chiller Designation : ACC-01	R	R	R	R	R
Design Properties	Cooling capacity : 1,000 kW Chilled water output temperature : 7ºC Chilled water inlet temperature : 12.5ºC Evaporator water flow rate : 43 l/s Ambient temperature : 35ºC AHRI's Coefficient of Performance : 3.2 AHRI's Integrated Part-load Value : 7 Compressor : screw/centrifugal		R	R	R	R
Classification Properties	Reference to the OmniClass table 23			R	R	R
Manufacturer's Equipment Properties	Rated cooling capacity : 1,080 kW Chilled water output temperature : 7ºC Chilled water inlet temperature : 12.5ºC Evaporator water flow rate : 47 l/s Ambient temperature : 35ºC AHRI's Coefficient of Performance : 3.4 AHRI's Integrated Part-load Value : 7.6 Compressor : centrifugal No. of compressor : 1 Manufacturer : XXX Co. Ltd. Supplier : YYY Co. Ltd. Brand : AAA Model number : ACC-CENT-1000 Country of origin : PRC				R	R
Condition Properties	Installation date : Sep 2020 Commissioning date : Oct 2020 Compressor life expectancy : 20 years Evaporator life expectancy : 20 years Condenser fan life expectancy : 15 years				R	R
Verification Properties	Field verification : laser scanning					R

Remark: R – Required

4.8.1 Level of Documentation (DOC)

DOC is the documentation requirement of a MEP model element. The minimum documentation requirements at various levels of LOD-I for building services installation are as following table.

Minimum DOC Requirements of LOD-I

BIM Object Properties	Object Documentation Requirements	LOD-I				
		100	200	300	400	500
Specification Properties	Product technical document (e.g. product technical sheet, catalogue, type test certificate, etc.), and other external document in the form of a hyperlink				R	R
	Operation and Maintenance Manual, Test and Commissioning Report, Test Certificates, etc., and other external document in the form of a hyperlink					R

For systems to be handed over to EMSD for operation and maintenance, archived document files storing in designated folder structure is required to upload to EMSD's Asset Management Platform for the assignment of document link path.

4.9 Sheet/Layout/Drawing Management

For consistent drawing sheet management and searching convenience in the BIM authoring software, Sheet Number/Layout ID/Drawing Name and Sheet Name should be inputted as follows:

Information in BIM authoring software	Input
Sheet Number/Layout ID/Drawing Name	Field 4 of the drawing number, please refer to Clause 2.8 on drawing number naming convention.
Sheet Name/Layout Name/Drawing Title	Drawing Title

Information on drawings title block should be extracted from property/parameter/attribute of the BIM model. Manual input is not recommended.

4.10 Presentation Style

The line weight and line type in 2D drawing presentation and the colour code in 3D model view for presentation should be standardised and follow the recommendations in Annex B - Color Code and Line Style for Systems. The recommended color code and line style should be applied for design, construction and as-built models.

4.11 Clearance Space for Operation and Maintenance

For construction and as-built model, the following major model elements/objects should incorporate clearance spaces to demonstrate operation and maintenance in the BIM model. Clearance should be included in the properties of objects to enable clash detection process in the BIM software tools;-

- Chiller;
- Boiler;
- Plate Type Heat Exchanger;
- Air-handling Unit/Primary Air Unit;
- High/Low Voltage Cubicle Switchboard;
- Generator;
- Condensing Units;
- Cooling Towers; and
- Valve set etc.

4.12 BIM Object File for MEP

BIM object file for MEP is a data file contains building services element and should include the graphical representation and non-graphical information to indicate the element's characteristics. It should also include the 2D component of symbol and tag/label/annotation if applicable.

The BIM object should be provided with a BIM Object Sheet to convince all parties that the BIM object created is complete, satisfying the requirements and the purpose of drawing production. The details for the creation of BIM object should refer to the CIC Production of BIM Object Guide – General Requirements. The sample format of BIM Object Sheet is enclosed in **Annex C**.

4.12.1 General Requirements for BIM Object Creation

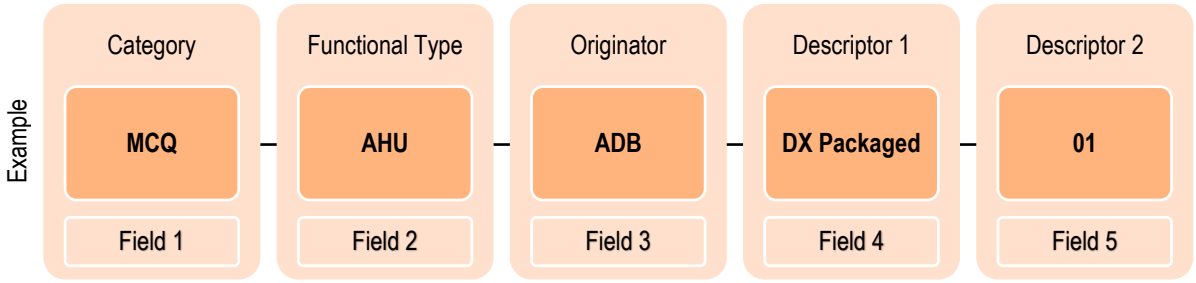
The following general requirements should be followed in creation of object:-

(a) The object file should include information of physical dimension for coordination of BIM model;
(b) Drawing symbol should be included in an object file for 2D drawing output and can be referenced to the CAD Standard for Works Projects (CSWP). The shape and size of symbol should be coordinated for easy reading in the drawing output;
(c) Symbolic 2D annotation (drawing symbol) should be visible while the 3D geometry should be invisible in drawing output of plan view;
(d) 3D geometry shall be visible for rendering in 3D view;
(e) Object file should include the material/equipment information;
(f) Nesting object file should be limited to 2 levels except for drawing symbol. It is important to understand that nesting object file increases the file size and affects performance, specifically the regeneration process of the object file views;
(g) Host object file should not be allowed;
(h) The LOIN, line styles, line weight, line pattern, text style and unit of measurement for modelling of object shall refer to relevant sections of this Guide;
(i) To minimize the object file size, only essential connectors should be used and the object file should be created directly from an object file template to reduce extra information in an object file;
(j) Level of the insertion/origin point of the object file is recommended at the centre point at the bottom level of the object; and
(k) The maximum size of each BIM object file used should be kept at the minimum, preferably under 5MB.

4.12.2 Object File Naming Convention

The recommended object file naming structure (4-5 fields separate by a hyphen between the fields) in design and construction stage is as below:

Format and Field



Requirements of each Field

	Requirements
Field 1 and Field 2 (Category / Functional Type)	- These two fields shall follow **CIC Master Type List** (https://www.bim.cic.hk/en/resources/master_list). - Field 1 shall be kept unique in value and meaning. - When Field 2 is not necessary to describe at the second level, three underscores (__) should be used.
Field 3 (Originator)	- Agent Responsible Code (ARC) should be used as originator. - If a BIM object is fully adopted without change, its name should be maintained. However, if the BIM object is modified, its originator code should be updated and saved as another BIM object.
Field 4 (Descriptor 1)	- Maximum 15 characters (alphanumeric) contains information about primary use and material - when applicable (e.g. DX Packaged, Outdoor Unit) - Capital letters should be used for first letter of each word - If Descriptor 1 is blank, three nos. of underscores (___) should be used in place of Descriptor 1 -
Field 5 (Descriptor 2)	- Optional field, Descriptor 2 is a 2-digit sequential number (e.g. 01 to 99) to distinguish different types that cannot be sufficiently identified by preceding fields. (e.g. MCQ-AHU-ADB-DX Packaged-01.xxx) - If Descriptor 2 is blank, two underscores (__) should be used in place of Descriptor 2. (e.g. - MCQ-SAC-ADB-Outdoor Unit-__.xxx)

Example:

Object File Name	Description
MCQ-AHU-ADB-DX Packaged-01.xxx	Object created by ArchSD BSB, Category: Mechanical Equipment Functional Type: Air Handling Unit Description: DX Package Type AUH
MCQ-SAC-ADB-Outdoor Unit-__.xxx	Object created by ArchSD BSB, Category: Mechanical Equipment Functional Type: Split Type AC Unit Description: Outdoor Unit

Remark: ".xxx" – file name extension

5. Data Requirements for Asset Management

5.1 Data Format of As-built Information

The requirements of BIM folder structure, file coding, naming convention, model presentation style (colour code, line type, line weight, etc.) and unit of measurement of the as-built BIM model for building services installations should make reference to the Building Information Modelling – Asset Management (BIM-AM) Standards and Guidelines issued by EMSD.

For the requirements of as-built BIM model for plumbing and drainage installations, reference should be made to the BIM Guide for Facilities Upkeep issued by Property Services Branch of the Architectural Services Department.

If the building MEP facilities would not be handed over to EMSD for maintenance (example: Schedule 2 hospital to be maintained by the Hospital Authority), the project client should be consulted on the detailed as-built BIM data requirements and the explicit referencing to the EMSD's BIM-AM Standards and Guidelines may not be required.

5.2 Deliverables

The following deliverables should be included in the as-built information file folder:-

(a) BIM execution plan indicating the adopted modelling methodology and details;
(b) As-built BIM models for all disciplines and 2D drawing files for building services installation;
(c) Design authoring tools' templates, title block, BIM object files and other necessary resources for viewing of the as-built BIM model;
(d) Testing and Commissioning reports;
(e) Operation and Maintenance manuals;
(f) Relevant statutory certificates, approval documents and forms; and
(g) Other relevant project information as required.

- END-

Annex A – Modelling Scope and LOIN Requirements

FS : Feasibility Study/Conceptual Design model
SD : Sketch Design/Approval-in-Principle (AIP) model
DD : Detailed Design/Detailed Design Approval (DDA) model
SA : Submission to Approval Authority (e.g. SCCU)
TN : Tender model
CON : Construction shop model
Ab : As-built model
V : Field verification
V(I) : Field verification by visual inspection
V(M) : Field verification by measured survey

BIM Object for MEP	Minimum LOD Requirements and Field Verification Method for as-built BIM Model Quality Assurance														
	FS		SD		DD		SA		TN		CON		Ab		
	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
HVAC Installation															
Chiller	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Heat pump	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Cooling tower	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Heat exchanger	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Calorifier	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Chilled water pump	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Heating water pump	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Condenser tube cleaning equipment	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
VRV/DX indoor and outdoor unit	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Standalone air-conditioner/Split-type unit	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Primary air unit (PAU)	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Air-handling unit (AHU)	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Fan-coil unit (FCU)	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Computer room air-conditioning (CRAC) unit	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Ventilation fan	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Booster fan	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Jet fan	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Rotary fan (fixed type)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Ceiling fan	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water scrubber	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Constant air volume box/air valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Variable air volume box/air valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

Annex A – Modelling Scope and LOIN Requirements

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BIM Object for MEP	Minimum LOD Requirements and Field Verification Method for as-built BIM Model Quality Assurance														
	FS		SD		DD		SA		TN		CON		Ab		
	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Air duct	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Chilled/Heating water pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Condensate drain pipe	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe (others)	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Valve (>20mm dia.)	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Air damper	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Fire/smoke damper	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Air diffuser/grille	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Direct digital control (DDC) panel	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
CCMS server/server rack	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Control console	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Steam and Hot Water System															
Steam /hot water boiler	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Heat exchanger	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Calorifier	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Feed/blow down water tank	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Steam /hot water pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Steam condensate pipe	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Steam flash vessel	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Valve (>20mm dia.)	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Steam trap	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Main control console/panel	-	-	-	-	200	200	-	-	200	300	300	400	300	500	V(I)
Electrical Installation															
Transformer (customer owned)	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)

Annex A – Modelling Scope and LOIN Requirements

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	FS		SD		DD		SA		TN		CON		Ab		
	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Switchboard cubicle	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Cut-out supply panel	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Motor control centre	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Motor control panel	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Uninterruptible power supply unit (except small-scale standalone UPS for computer)	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Variable speed drive (standalone)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
MCCB /MCB board	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Socket outlet	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Floor box	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fuse spur unit	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Electric vehicle charging panel /station	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Generator set	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Generator remote radiator	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Generator cooling water pump	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel pump	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel valve (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Photovoltaic panel	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Wind turbine	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Capacitor bank cubicle	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Harmonic filter cubicle	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Control/metering panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

Annex A – Modelling Scope and LOIN Requirements

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BIM Object for MEP	Minimum LOD Requirements and Field Verification Method for as-built BIM Model Quality Assurance														
	FS		SD		DD		SA		TN		CON		Ab		
	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Luminaire/light fitting	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Lamp pole/bollard	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Stage lighting bar	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Occupancy /daylight sensor	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Power busduct	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Cable ladder	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Cable tray	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Trunking	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fire Services Installation															
Sprinkler/FS/Booster water pump	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Water tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Street fire hydrant	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fire hydrant/Hose reel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sprinkler control valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sprinkler pre-action valve set	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sprinkler flow switch	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sprinkler head	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Gas flooding spray head	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Drencher spray head	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fire/Smoke/Heat /Beam detector	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Breakglass unit	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Alarm bell	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Visual fire alarm	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fire alarm / battery panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

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BIM Object for MEP	Minimum LOD Requirements and Field Verification Method for as-built BIM Model Quality Assurance														
	FS		SD		DD		SA		TN		CON		Ab		
	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Portable fire extinguisher	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fixed automatically operated appliance	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Exit /Directional sign	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Emergency luminaire	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Valve (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pressurization fan	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Smoke extraction fan	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Smoke extraction air duct	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Total flooding gas pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Burglar Alarm and Security Installation															
Drop arm barrier	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Mechanical road block	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Access card reader	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Door release button	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Emergency breakglass unit	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Doorphone unit	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
CCTV camera	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Movement detector	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Glass break detector	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Watchman tour patrol point	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Centralized security system server/rack	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
CCTV video recorder/rack	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
CCTV control console	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

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CCTV/Security system display panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Security system control panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Broadcast Reception Installation															
Aerials	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Preamplifier /Amplifier	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fibre optical panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Outlet	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Lift and Escalator Installation															
Lift car	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Lift machine	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Lift landing call panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fireman's switch	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Dumbwaiter car	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Escalator	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Passenger conveyor	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Vertical lifting platform	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Stairlift	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Catering Equipment															
Food processing equipment	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sink	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Dish washer	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Refrigerator	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Freezer	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Liquefied Petroleum /Town Gas Installation															

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	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Gas pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Gas valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Outlet	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Swimming Pool Water Treatment Installation															
Sand filter	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Ozone reaction tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Carbon filter tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Ozonator	-	-	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Sodium hypochlorite generation equipment	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Hypochlorite storage tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Hydrogen blower	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Hydrogen gas detection system	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
pH and Chlorine controller	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Mixed oxidant disinfection equipment	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Brine tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Mixed oxidant solution tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
UV chamber	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water pump set	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water valve (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Medical Gas Pipeline System															
Vacuum insulated Evaporator (VIE) tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(M)
Oxygen manifold	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Medical /non-medical air compressor plant	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)

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	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	LOD-G	LOD-I	V
Air receiver	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Air dryer	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Dust /carbon filer	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Bacteria filer	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Compressed air manifold	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Anaesthetic gas scavenging manifold	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Vacuum air compressor	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Vacuum receiver /vessel	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Medical gas alarm zone panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Medical gas pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Medical gas valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Medical gas outlet	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Mechanical Installation															
Gondola	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(M)
Fuel filling station	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel tank	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fuel valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Car washing equipment	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Compressed air equipment	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Winch and pulley set	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Hoisting set	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pneumatic Tube Transportation System															
Blower	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

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Diverter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Reject station	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Empty chamber storage station	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Valve	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Transport station	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Transport tube	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Controller panel	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Automatic Refuse Collection System															
Refuse chute/pipe	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Compactor	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Exhauster	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Container	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Conveyor	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Refuse separator	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Refuse disposal inlet	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Inlet/discharge valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Diverter valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Air treatment device	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Air blower	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Plumbing Installation															
Water tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Water pump set	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Pneumatic tank	100	100	100	200	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

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Valve (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Rainwater Harvesting Installation															
Water tank	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sand filter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Carbon filter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Cartridge filter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
UV chamber	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pump set	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pneumatic tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Valve (>20mm dia.)	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Drainage Installation															
Drainage pipe	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Manhole	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Storm water inlet	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Floor drain inlet	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Sewage Pumping System															
Sewage pump	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Sewage pipe	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Sewage valve	-	-	100	100	200	200	200	200	200	300	300	400	300	500	V(I)
Greywater Recycling System															
Water tank	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sand/Coarse filter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Membrane bioreactor unit	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

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UV chamber	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pump set	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pneumatic tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sewage Water Treatment System															
Water tank	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Sand/Coarse filter	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Membrane bioreactor unit	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
UV chamber	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pump set	100	100	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Pneumatic tank	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Water pipe	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Valve	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Fixing and Maintenance Accessories															
Hanger	-	-	-	-	-	-	-	-	-	-	300	400	300	500	V(I)
Spring Isolation Unit	-	-	-	-	-	-	-	-	-	-	300	400	300	500	V(I)
Hoisting beam and chain block	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)
Hoisting eye	-	-	100	100	200	200	-	-	200	300	300	400	300	500	V(I)

Annex B – Color Code and Line Style for Systems

System/Installation	System Code	Presentation (2D)			Presentation (3D)				
		Lineweight	Linetype		RED	GREEN	BULE	Color Palette	
HVAC System									
Primary Air Duct	PAD	0.35	Continuous		0	255	255		
Exhaust Air Duct	EAD	0.35	Continuous		0	255	0		
Fresh Air Duct	FAD	0.35	Continuous		0	0	255		
Supply Air Duct	SAD	0.35	Continuous		255	0	0		
Return Air Duct	RAD	0.35	Continuous		255	0	255		
Transfer Air Duct	TAD	0.35	Continuous		0	128	255		
Smoke Extraction Duct	SED	0.35	Continuous		128	128	0		
Make Up Air Duct	MAD	0.35	Continuous		192	192	192		
Staircase Pressurization Duct	SPD	0.35	Continuous		192	192	192		
Condensate Drain Pipe	CDP	0.18	Dashed2		255	128	0		
Chilled Water Return Pipe	CHWR	0.25	Dashdot2		0	255	0		
Chilled Water Supply Pipe	CHWS	0.25	Dashdot2		0	0	255		
Condensing Water Supply Pipe	CDWS	0.25	Border2		0	128	64		
Condensing Water Return Pipe	CDWR	0.25	Border2		0	128	255		
Chemical Dosing Pipe	CHDP	0.25	Hidden		192	192	192		
Make-up Water Pipe	MWP	0.25	Continuous		192	192	192		
Heating Hot Water Supply Pipe	HHSP	0.25	Phantom2		128	0	0		
Heating Hot Water Return Pipe	HHRP	0.25	Phantom2		255	128	64		
Electrical Installation									
Low Voltage Electricity Supply	ES-LV	0.35	Divide2		0	255	0		

Annex B – Color Code and Line Style for Systems

System/Installation	System Code	Presentation (2D)			Presentation (3D)			
		Lineweight	Linetype		RED	GREEN	BULE	Color Palette
High Voltage Electricity Supply	ES-HV	0.35	Divide2		0	255	0	
Normal Power	TR-N	0.35	Dashdot2		0	255	0	
Emergency Power	TR-E	0.35	Continuous		255	0	64	
Building Management System	BMS	0.35	Continuous		0	255	0	
Uninterruptible Power supply	UPS	0.35	Continuous		128	64	64	
Lighting General	LTG	0.35	Centre2		0	255	0	
LV Switchboards	LVS	0.35	Divide2		128	128	0	
Emergency Generator	EMG	0.35	Continuous		255	0	64	
Fire Services Installation								
Sprinkler Pipe	SPR	0.25	Continuous		255	0	0	
Hose Reel/Fire Hydrant Pipe	FSP	0.25	Continuous		255	0	0	
Automatic Fire Detection and Alarm System Pipe	AFA	0.25	Divide2		255	0	0	
Gas Suppression System Pipe	GSS	0.25	Continuous		255	0	0	
Burglar Alarm and Security Installation								
Access Control System	ACS	0.25	Continuous		128	255	255	
Burglar Alarm System	BAS	0.25	Continuous		128	255	255	
CCTV and Intercom System	CCTVI	0.25	Continuous		255	153	102	
Smart Card System	SCS	0.25	Continuous		128	255	255	
Call Alarm System	CAS	0.35	Centre2		128	255	255	
Videophone System	VPS	0.25	Continuous		128	255	255	
Keypad Lock System	KLS	0.25	Continuous		128	255	255	

Annex B – Color Code and Line Style for Systems

System/Installation	System Code	Presentation (2D)			Presentation (3D)			
		Lineweight	Linetype		RED	GREEN	BULE	Color Palette
Drop-arm Barrier	DAB	0.25	Continuous	———	128	255	255	
Electronic Systems								
Broadcast Reception System	BRI	0.35	Continuous	———	128	255	255	
Radar and Navigation System	RNS	0.25	Continuous	———	0	153	0	
Microwave Link System	MLS	0.25	Continuous	———	0	64	64	
Timing & Display System	TDS	0.25	Continuous	———	128	128	128	
Audio Video System	AV	0.25	Continuous	———	0	128	128	
Audio System	AUS	0.25	Continuous	———	102	102	51	
Radio System	RS	0.25	Continuous	———	204	153	255	
Lift and Escalator Installation								
Lift/Escalator	LAE	0.25	Continuous	———	128	0	128	
Swimming Pool Water Treatment System								
Filtration Plant Pipe	FP	0.25	Continuous	———	0	128	0	
Return Pipe	RP	0.25	Continuous	———	0	128	128	
Overflow Pipe	OP	0.25	Continuous	———	0	128	0	
Supply Pipe	SP	0.25	Continuous	———	0	128	255	
Plumbing Installation								
Cleansing Water Pipe	CLWP	0.25	Dash	— —	0	0	255	
Cold Water Pipe	CWP	0.25	Long Dash Dash	—— - —— - ——	0	0	255	

Annex B – Color Code and Line Style for Systems

System/Installation	System Code	Presentation (2D)			Presentation (3D)				
		Lineweight	Linetype		RED	GREEN	BULE	Color Palette	
Flushing Water Pipe	FLWP	0.25	Centre		255	255	0		
Fresh Water Pipe	FWP	0.25	Continuous		0	255	0		
Hot Water Supply Pipe	HWSP	0.25	Dash dot		255	0	0		
Hot Water Return Pipe	HWRP	0.25	Long Dash dot		255	128	128		
Irrigation Water Pipe	IRWP	0.25	Dash dot dot dot		0	255	255		
Grey Water Pipe	GWP	0.25	Continuous		0	128	255		
Steam Pipe	BLR	0.35	Continuous		255	255	0		
Drainage Installation									
Waste Pipe	WP	0.35	Divide2		128	128	0		
Soil and Waste Pipe	SWP	0.35	Centre2		128	0	0		
Vent Pipe	VP	0.35	Hidden		0	128	255		
Rainwater Pipe	RWP	0.35	Phantom2		0	255	255		
Pumped Soil & Waste Pipe	PSWP	0.35	Centre2		64	0	0		
Pumped Waste Pipe	PWP	0.35	Divide2		64	64	0		
Pumped Rainwater Pipe	PRWP	0.35	Phantom2		0	128	128		

Annex C – Sample Format of BIM Object Sheet