





#### Erasmus+ Project ID: BIMVET3 2020-1-ES01-KA203-083262

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# Title: BIM MEP Model with Revit

## 1 – Aims

Ability to develop a BIM MEP model, specifically in the plumbing system.

Ability to create isometric views and sheets using Revit software.

Ability to transmit information using BIM.

### 2 - Learning methodology

The teacher will give an explanation about the use of the tool.

Students will read this tutorial and watch the videos, do the exercise and explore the MEP tools and environment.

To assess the achievement of the task, each student needs to create the Domestic Cold Water system and the sheets designs.

## **3 - Tutorial duration**

The task described in this tutorial will be carried out in a computer classroom.

It will last 6 teaching hours.

#### 4 – Necessary teaching resources

Computer room with PCs with internet access.

Required software: Revit.

Hardware required: Computer with the capacity to support the software.

### 5- Contents & tutorial

- **5.1 Introduction**
- 5.2 Revit MEP Interface
- **5.3 Starting a Project**
- 5.4 Link an Architectural Model





5.5 Add Levels

**5.6 Plumbing Systems** 

- **5.6.1 Plumbing Fixtures**
- 5.6.2 Create the Domestic Cold Water System
- 5.6.3 Annotations
- **5.6.4 Create Schedules**
- **5.6.5 Create Isometric Views**
- 5.6.6 Create Sheets

## 6- Deliverables

A report of 3 pages showing the execution of the task.

## 7- What we have learned

How to link an architectural model in an MEP project.

How to place plumbing fixtures.

How to create a Domestic Cold Water system, with pipes and pipe fittings.

## 8 - Files to use in this tutorial

The project file created in the Revit Architecture tutorial in .rvt format.

# 5- Contents & tutorial

## **5.1 Introduction**

Revit MEP is a part or functionality of Autodesk Revit software, for professionals who are working in three engineering disciplines, Mechanical, Electrical, and Plumbing, in isolation or as part of a BIM project. It is a set of Revit tools that allow the elaboration of BIM models, used to streamline the engineering design process, making the design and development of projects more efficient.

This tutorial is not intended to teach how to dimension plumbing and mechanical systems, but rather how to use Revit main tools to model the systems using the software. It is an exercise in exploring the system, which does not consider the rules for installing systems, which vary by country.

# BIMVET3

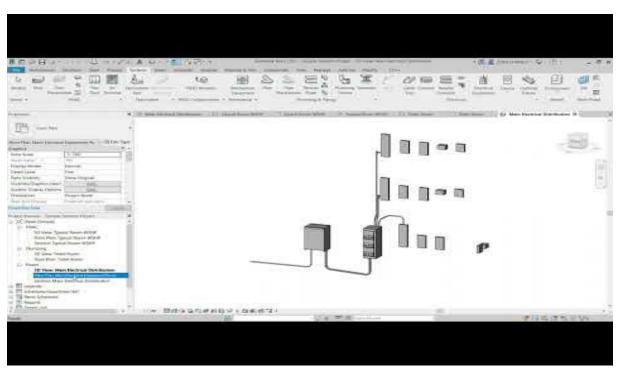


In this tutorial, the Basic Families from the Revit library will be used. However, currently, several brands that manufacture system components make their families available for downloading on their websites, configured according to the dimensions, materials and other parameters found on the market, so that the project is as close to reality as possible.

# **5.2 Revit MEP Interface**

It is important to understand that Revit MEP is not software which is independent of Revit, but a component part of it.

As in the Revit Architecture tutorial, it was already possible to become familiar with the work environment and the navigation and editing tools. In the following video, some tools for specific use in MEP projects will be demonstrated.



#### https://www.youtube.com/watch?v=m3V97Pxsdt4

# **5.3 Starting a Project**

After opening the program, on the Revit home page, click on New, and the New Project window will open to select the project template to be worked on. In this case, a pre-defined Revit template, Metric-Systems, will be used.



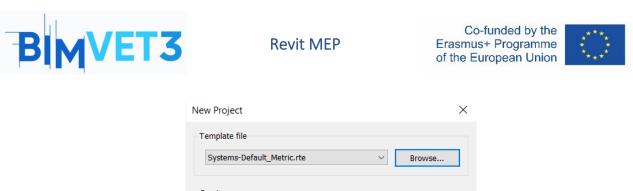


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<b>B</b> BIM 360			
	Sample Architecture Proj	Sample Structure Project	

If the Metric-Systems Template does not appear in the options of the New Project window, click on Browse to load this template. The Choose Template window will open, and in the English folder (Program Data/Autodesk/RVT 2022/Templates/English), select the "Systems-Default\_Metric" file, then click Open to load it.

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etric Lib	Files of type: Template Files (*.rte)		~				

After loading the Template, select it in the New Project window and in Create New, select the Project option.



Systems-Default	_Metric.rte	✓ Browse	
reate new			
Project		O Project template	

After opening the Template, it is important to define the measurement units that will be used in the project. To do so, click on the Manage tab, panel Settings and select the Project Units option.

ľ	Project	Parameters	Transfer Project Standards		
			🛐 Purge Unused		
۲	Global	Parameters	Project Units		
Settings					

Next, a window will open where the measurement units for each parameter are shown. We will change the Length that will be changed to Meters, with two decimal places and Slope parameter too, which will be changed to Percentage. For areas, volumes and angles, two decimal places in the Rounding option should also be defined.

Project Units			×
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Length		1234.57	m
Mass Density		1234.57 kg	g/m³
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Format			×
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# 5.4 Link an Architectural Model

MEP projects are typically created using linked architectural models. The linkage allows working in a collaborative and coordinated way between the architecture and MEP disciplines. If the linked model in the project is modified, Revit will automatically update the model each time the project is opened.

In this tutorial, you will link the architectural model that was created earlier in the Revit Architecture tutorial. To link, access the Insert tab and click on the Link Revit icon.



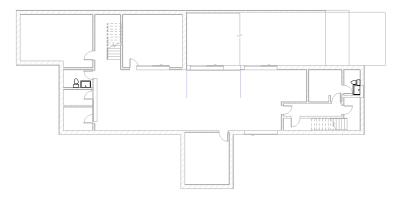
A window then appears to select the file to be imported. Browse and search for the project file made in the Revit Architecture tutorial, then select it. For Positioning, specify the desired option, in most cases you should select "Auto – Internal Origin to Internal Origin". Click on Open.



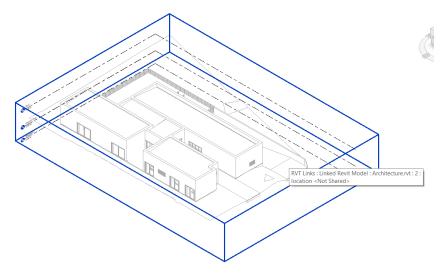


R Import/Link RVT		? ×
Look in: Filstory Documents My Computer My Netwo Favorites	Área de Trabalho  Nome  OneDrive - Personal  Seste Computador Bibliotecas Rede  Architecture	Preview Views •
	File name:	]
Desktop	Files of type: RVT Files (*.rvt)	
Tools 👻	Positioning: Auto - Internal Origin to Internal Origin	]
	Qper	Cancel

The linked model will then be displayed in the Drawing Area.



When the mouse cursor passes over the architectural model Link drawing, a blue selection box appears. Sometimes these blue lines get in the way of the design visualization.







To disable the selection of linked models, you must click on the Select Links icon in the Selection Toggles bar so that the Selection Box no longer appears.

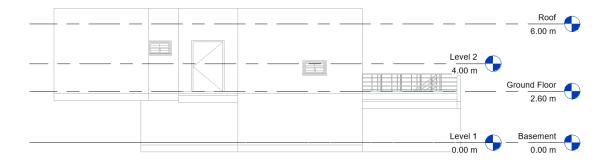


# 5.5 Add Levels

The pre-defined template (Systems-Default\_Metric) provides only 2 levels (Level 1 and Level 2), and according to the needs of each project, it may be necessary to create more.

When opening one of the Elevations views from the Project Browser, it is possible to view the template levels, and the levels of the imported model (Basement, Ground Floor and Roof) are also visible.

The levels of the linked architectural model are just a graphical representation and cannot be used as a reference in the current project. All the elements of the linked model are in a single block, which makes it impossible to change, so it is necessary to insert levels in the current project that overlap those of the architectural model.



It is recommended that Level 1 and Level 2 are renamed "Basement" and "Ground Floor", respectively, and that their heights be changed so that they are on top of the levels of the imported design (0.00 m and 2.60 m). A third level should be created and named "Roof", with a height of 6.00 m.

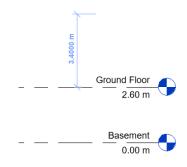
To create this new level, for *Roof*, in the Architecture tab, *Datum panel*, click on *Level*.

1.4	Level
ŝĤ	Grid
Da	atum

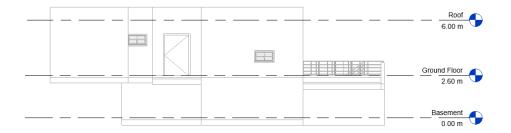




When you approach the mouse cursor from *the Ground Floor level*, a temporary dimension will then appear relative to the *Ground Floor level*, which serves as a preview of the level to be inserted. Depending on the mouse movement, the dimension changes.



In relation to *the Ground floor*, the new floor will have 3.40 m. After viewing the temporary dimension of 3.40 m, just click on the drawing area and the new level will be inserted.



In addition to creating a level for each story in a building, you can also create reference levels, such as sill level.

## **5.6 Plumbing Systems**

The domestic water system is divided into the following systems: Cold Water, Hot Water and Sanitary. In this tutorial an example of creating a Domestic Cold Water system will be shown.

### **5.6.1 Plumbing Fixtures**

Before starting to create a system, it is necessary to insert the plumbing fixtures, such as sinks, waterclosets, bathtubs, and so on. Even though these elements have already been added to the Architecture model, when the architecture is inserted through the Revit link, all its elements are in a single block, which makes it impossible to change. Therefore, it is necessary to insert the family in the plumbing project again, overlapping the architecture family.







Therefore, in the Project Browser, open the "1- Plumbing" view, which corresponds to the Basement plant (if necessary, it is possible to rename it). (image) In the Systems tab, Plumbing & Piping panel, click on the Plumbing Fixture icon.

Project Browser - Projeto MEP	Х
[] Views (Discipline)	
Electrical	
🖬 Mechanical	
Plumbing	
·····???	
HVAC	
Plumbing	
Floor Plans	
1 - Plumbing	
2 - Plumbing	
3D Views	
Elevations (Building Elevation)	
Schedules/Quantities (all)	
Sheets (all)	
E Families	
🗄 🔞 Groups	
🗄 📟 Revit Links	

On the Systems tab, Plumbing & Piping panel, click on the Plumbing Fixture icon.



In the Properties Palette, any device selected by Revit will appear. To change the selected equipment, simply click on the image/description of the element.

Properties					Х
	M_Sink - Isla 455 mmx455	-			•
New Plumbi	ng Fixtures	```	🗸 🔠 Edit	Тур	e
Constraints				*	^
Schedule Le	evel	Level 1			
Elevation fr	om Level	0.0			
Host		<not associated<="" td=""><td>&gt;</td><td></td><td></td></not>	>		
Plumbing				*	
Flow Pressu	re	55158.000000 Pa	3		
Mechanical				*	
System Clas	sification	Domestic Cold V	Vater,Do		
System Typ	e	Undefined			
System Nar	ne				
System Abb	previation				
Identity Data	1			*	~
Properties he	elp	:	Арр	ly	

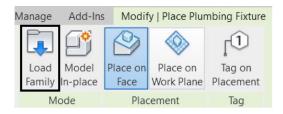




The Type Selector will then open, where a list of several families of Revit equipment appears. Use the scroll bar to see all available parts.



For this example, none of the devices that initially appear in the Type Selector list will be used, as new families will be loaded. To do this, after clicking on the Systems tab and the Plumbing Fixture icon, the Modify |Place Plumbing Fixture tab will open, and so click on Load Family.



The Load Family window will open, in which the following path must be accessed: ProgramData/Autodesk/RVT 2022/Libraries/English/Plumbing/MEP/Fixtures. Inside the Fixtures folder, there are several folders named according to the type of equipment. Open the Water Closets folder.





R Load Family				? ×
Look in:	] Fixtures		~ 🔶 🍡	🗙 📙 Views 👻
Documents         Documents         My Computer         Image: Computer	Nome Water Closets Urinals Sinks Showers Lavatories Emergency Fixtures Drinking Fountains Drains Connectors Bathtubs Appliances	Tipo	Preview	
Metric Lib	File name:		~	
V V	Files of type: All Supported Files (*.r	fa, *.adsk)	~	
Too <u>l</u> s ▼			<u>O</u> pen	Cancel

When opening the Water Closets folder, some families of elements of this classification appear. Pressing the CTRL key, select the families: "M\_Water Closet – Flush Tank" and "M\_Bidet", and click Open to load them into the project.

R Load Family	? ×
Look in: 📜 Water Closets	Views 🗸 🐂 Views 🗸
Nome       Tipo         History       M_Water Closet - Quiet Flush Tank         M_Water Closet - Flush Valve - Vall Mounted       M_Water Closet - Flush Valve - Floor Mounted         M_Water Closet - Flush Tank       M_Water Closet - Flush Tank         M_Water Closet - Flush Tank       M_Water Closet - Flush Tank         M_Water Closet - Flush Tank       M_Water Closet - Flush Tank         M_Water Closet - Flush Tank       M_Water Closet - Flush Tank.         Flue name:       M_Water Closet - Flush Tank.rfa         Files of type:       All Supported Files (*.rfa, *.adsk)	Preview
Tools 🗸	Open Cancel

Repeat the same process to load the following families:

- Sinks:
  - M\_Sink Work
  - M\_Sink Service
- Showers:
  - M\_Shower Stall Rectangular

Note: In the Properties Palette, duplicate the element and create 4 new ones with the following dimensions:





1.60 m x 1.00 m 1.30 m x 1.30 m 1.45 m x 0.90 m 1.20 m x 0.90 m

- Lavatories:
  - M\_Lavatory Rectangular
- Bathtubs:
  - M\_Bath Tub Maestro

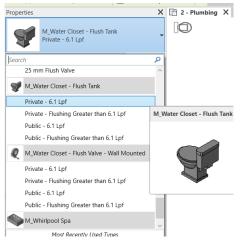
Note: In the Properties Palette, click on Edit Type and change the parameters Bath Tube Width to 1.10 m and Bath Tube Length to 2.50 m.

• Appliances:

\_

- M\_Washing Machine
  - M\_Dishwasher

After loading all the families, you can insert these elements into the view. In the Systems tab, Plumbing & Piping panel, click on the Plumbing Fixture icon. Now in the Properties Palette, in the Type Selector, all the loaded families appear. Select the "Private - 6.1 Lpf" type from the "M\_Water Closed – Flush Tank" family.



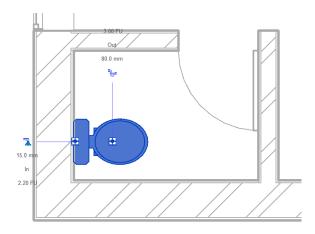
With the element selected, move the cursor to where you want to insert it. To rotate the object, you can use the spacebar on the keyboard. When the object is positioned, just click on the drawing to insert it.



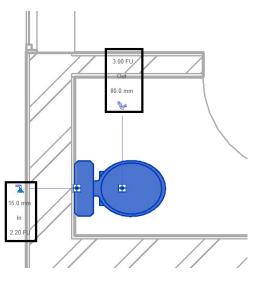


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When clicking on the inserted equipment, the Properties Palette identifies the object and customized changes can be made according to each project. Next to the object, the identifications of the water inlet and outlet connectors appear.



Insert all other elements with the following distribution:

View: 1- Plumbing (Basement floor): WC 1:

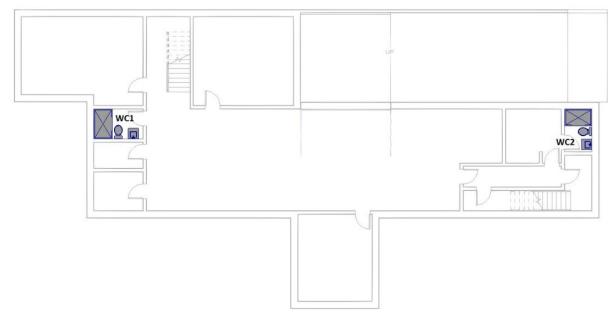
- M\_Water Closet Flush Tank Private 6.1 Lpf
- M\_Lavatory Rectangular Private 560 mmx560 mm
- M\_Shower Stall Rectangular 1,60 m x 1,00 m Private

WC 2:

- M\_Water Closet Flush Tank Private 6.1 Lpf
- M\_Lavatory Rectangular Private 560 mmx560 mm
- M\_Shower Stall Rectangular 1,45 m x 0,90 m Private







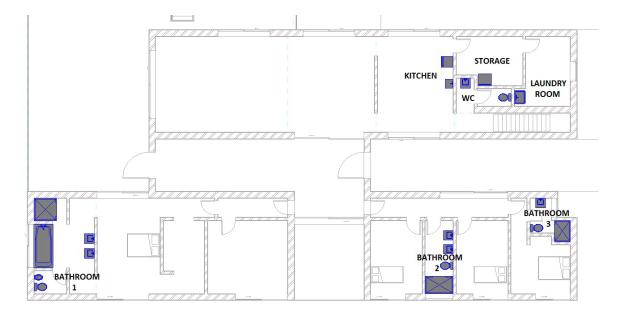
#### View: 2 – Plumbing (Ground Floor)

- Bathroom 1:
  - M\_Water Closet Flush Tank Private 6.1 Lpf
  - M\_Bidet
  - M\_Bath Tub Maestro Private
  - M\_Lavatory Rectangular Private 560 mmx560 mm
  - M\_Shower Stall Rectangular 1,30 m x 1,30 m Private
- Bathroom 2:
  - M\_Water Closet Flush Tank Private 6.1 Lpf
  - M\_Lavatory Rectangular Private 560 mmx560 mm
  - M\_Shower Stall Rectangular 1,60 m x 1,00 m Private
- Bathroom 3:
  - M\_Water Closet Flush Tank Private 6.1 Lpf
  - M\_Lavatory Rectangular Private 560 mmx560 mm
  - M\_Shower Stall Rectangular 1,20 m x 0,90 m Private
- Kitchen:
- M\_Sink Work
- M\_Dishwasher
- WC:
- M\_Water Closet Flush Tank Private 6.1 Lpf
- M\_Lavatory Rectangular Private 560 mmx560 mm
- •
- Laundry Room:
  - M\_Sink Service
- Storage:
- M\_Washing Machine









Note: For the element "M\_Sink - Work" it is necessary to edit the elevation in relation to the floor. For this, select the element and in the Properties Palette, in the Elevation from level field, fill in the value of 0.80 m.

Properties	×
M_Sink - Wor 510 mmx455	
Plumbing Fixtures (1)	v 🗟 Edit Type
Constraints	* ^
Level	Ground Floor
Elevation from Level	0.8000 m
Host	Level : Ground Floor
Offset from Host	0.8000 m
Plumbing	*
Flow Pressure	55158.000000 Pa
Mechanical	\$
System Classification	Domestic Cold Water,Do 🗸
Properties help	Apply

# 5.6.2 Create the Domestic Cold Water System

After inserting all the fixtures, it is possible to start creating the Domestic Cold Water layout. To do so, click on one of the inserted plumbing fixtures, and then on the Piping icon on the Modify tab.





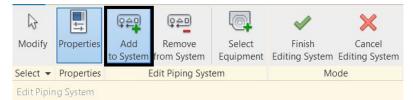




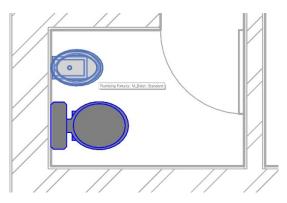
The Create Piping System window will appear, in which the Domestic Cold Water option must be selected in System type. In the System name field, the name of the system can be changed (in this case it will be kept), and the option Open System Editor must be checked. After these settings, click on OK.

Create Piping S	?	$\times$	
System type:	Domestic Cold Wate	er	$\sim$
System name:	Domestic Cold Wate	er 1	
	Open in System I	Editor	
	ОК	(	Cancel

Select the Add to System tool to add other fixtures to the system.



Move the mouse cursor closer and click on all the fixtures on the Basement and Ground Floor.



After selecting all the devices, click on Finish Edit System <

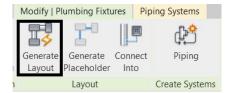
There are two ways to design the pipes: manually or through automatic solutions generated by Revit, which can be changed after to insert.

To generate it automatically, just click on one of the elements that was added to the system and on the Modify | Plumbing Fixtures, click on the Generate Layout icon.









Revit will then read the elements that have been added to the system, and generate solutions from the arrangement of these elements. The Generate Layout tab will open, where some editing tools appear.

T/	Т <mark></mark>		F	to;	Q:	O,	Slope	e Value	e:		<b>~</b>	×
Edit Layout	Solutions		Remove from Syste		Remove Base	Modify Base	0.00	00%		•		Cancel Layout
	Modify Layout						SI	ope		Genera	te Layout	
Genera	ate Layout	Solutio	on Type	Network		$\sim$	2 of 2	ا∢	∎	Sett	ings	

In the Generate Layout bar, it is possible to select the solution type in Solution Type, which can be Network, Perimeter or Intersection, according to the designer's preferences. In this example, the Network option will be kept. Next to the solution type, there is the number of solutions generated by Revit. In this case, two were generated.

Generate Layout Solution Type	Network	✓ 2 of 2	ا∢	IÞ	Settings	
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The design model usually establishes the elevations and types of pipes as well as their diameters. However, it may be necessary to specify pipe types and standard elevations for system piping.

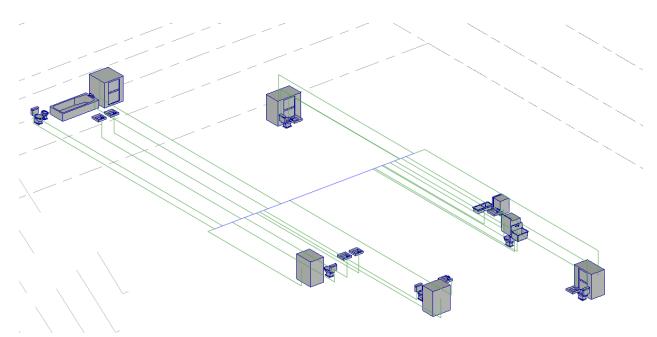
Clicking on Settings opens the Pipe Conversion Settings window. In the Main item, in the Pipe Type parameter, select the material "PVC - DWV" and in Offset, define the value of -0.20m, for the pipes to pass below the slab. For the Branch item, make the same changes.

Pipe Conversion Settings		×
<mark>Main</mark> Branch	System Type: Domestic Colo	d Water
	Setting	Value
	Ріре Туре	Pipe Types: PVC - DWV
	Offset	-0.2000 m
	J	
		OK Cancel

One of the solutions generated by Revit was the one shown in the image below (Solution 1/2 of the Network type). However, it is not the ideal solution, and it is necessary to make some adjustments. As it is an automatically generated solution by the software, there may be differences from one computer to another, and even more solutions.







To edit the solution, click on Edit Layout.



With this tool it is possible to drag the inserted pipes and reposition them in the System. In this case, no edits will be made, as adjustments can also be made manually outside the Layout editing.

The diameters of pipes and connections will also be changed later. By definition, all are 15mm in diameter.

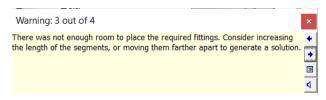
Click Finish Layout to complete.



At the end, some errors may appear, one of which may be due to a connection that was left open as shown in the following image.



The above error may be related to another error due to not having space to place accessories.



When showing error windows, the element is highlighted in the drawing for you to check. Now you must proceed, because the errors will be corrected later.

Using the Project Browser, access the "2-Plumbing" floor plan corresponding to the Ground Floor. As the System was inserted -0.20m below the slab of this floor, it will not be visible in this view. To make it visible, in the Properties Palette, in the View Range parameter, click Edit.

Properties				
Floor Plan			•	
Floor Plan: 2 - Plumbing	~	🔠 Edit Typ	be	
Sun Path			~	
Underlay		\$		
Range: Base Level	Basement			
Range: Top Level	ge: Top Level Unbounded			
Underlay Orientation Look down				
Extents		\$		
Crop View				
Crop Region Visible				
Annotation Crop				
View Range	Edit			
Associated Level	Ground Floor			
Scope Box	None			
Depth Clipping				
Identity Data		\$	Y	
Properties help		Apply		

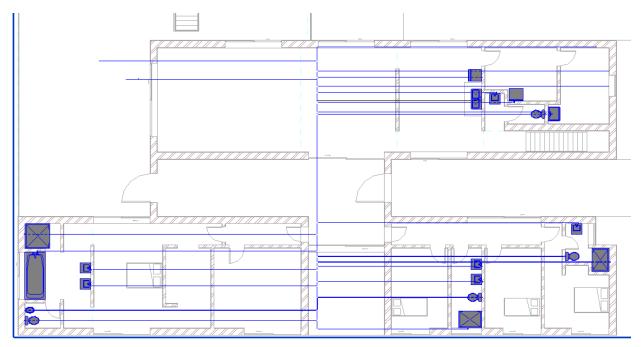
The View Range window will then open. In View Depth, change the Level parameter to "Unlimited" and then click OK.





View Range			×
Primary Range			
Тор:	Associated Level (Ground F $ \smallsetminus$	Offset:	4.0000 m
Cut plane:	Associated Level (Ground F $ \smallsetminus$	Offset:	1.2000 m
Bottom:	Associated Level (Ground F $ \smallsetminus$	Offset:	0.0000 m
View Depth			
Level:	Unlimited $\lor$	Offset:	0.0000 m
Learn more about	t view range		
<< Show	ОК	Apply	Cancel

Therefore, the entire system is visible in the view from this floor.



An important tip that helps to improve the visualization of the elements is to decrease the thickness of the contour lines. To do this, click on the Thin Lines tool, located on the Quick Access Toolbar.



Another tip that can help in graphic visualization is to set the Detail Level to the Fine option, and the Visual Style to Realistic or Consistent Color.

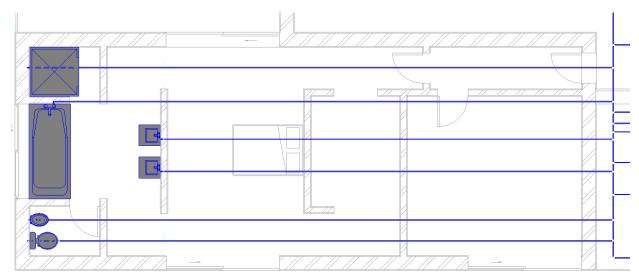
> 🖬 📾 🕫 😔 🖗 🛤 🖬 <

# BIMVET3



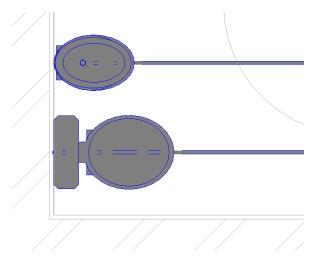
From the network layout automatically generated by Revit, manual edits will be made to better adapt it, so that the pipelines are optimized. There is not only one design solution for this hydraulic system, so the network layout varies according to work preferences.

As a demonstrative example, the system region shown in the image below will be edited. It is suggested that the tracing of the other regions also be edited according to preferences.



To make your system settings easier to see, you can open elevation views in the Project Browse, and create section views using the Sections tool on the Quick Access Toolbar.

To begin with, the Bidet and Watercloset connections will be excluded in the Bathroom 1, as shown in the following image. To delete an element, just click on it and press the delete key. Check in the 3D view that all connections have been deleted.

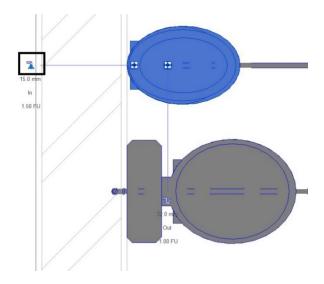




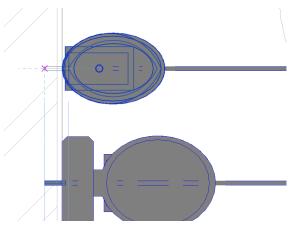




To start tracing the network manually, select one of the elements and click on the  $\sim$  "In" icon of the equipment.



Then, a line that represents the piping path appears, which moves according to the movement of the mouse cursor. Observe the temporary dimension and insert 0.10 m into the wall.



In the Systems tab, Plumbing & Piping panel, select the Pipe tool.



In the Properties Palette, verify that the "PVC – DWV" pipe type is selected.



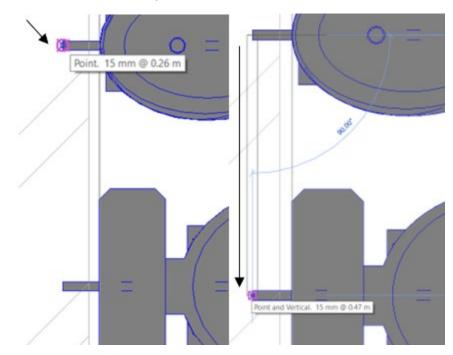


Pipe Types PVC - DWV Pipes (1) ~ @ Edit Constraints Horizontal Justification Center Vertical Justification Middle Reference Level Basement		
Constraints Horizontal Justification Center Vertical Justification Middle		
Horizontal Justification Center Vertical Justification Middle	Ту	pe
Vertical Justification Middle	\$	^
	]	
Peference Level Pasement		
Nelelence Level Dasement		
Top Elevation 2.4107 m		
Middle Elevation 2.4000 m		<
Bottom Elevation 2.3893 m		
Start Middle Elevation 2.4000 m		
End Middle Elevation 2.4000 m		
Slope 0.0000%		
Dimensions	\$	
Outside Diameter 21.3 mm		
Inside Diameter 15.8 mm		
Size 15 mmø		ſ.,
Properties help App		×

In the options bar, check if the diameter of 15mm is selected.

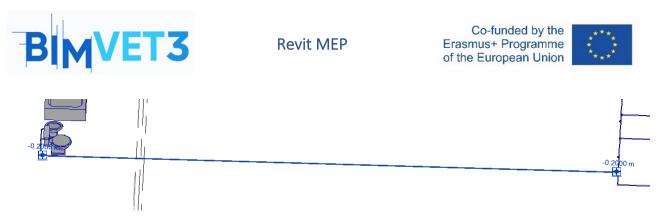
Modify   Pipes	Diameter:	15.0 mm	~
----------------	-----------	---------	---

With this, bring the mouse cursor closer to the end of one of the connections already inserted, and drag to the other one, to connect the two objects.



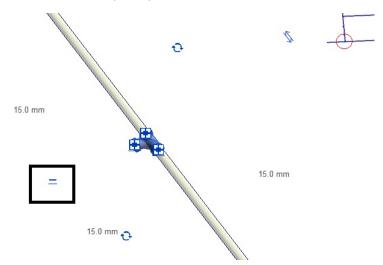
The pipe that goes under the toilet will also be deleted and a new one will be drawn with the Pipe tool so that it lines up with the pipe at the other end.

You must select the pipe and delete it before creating the new one.

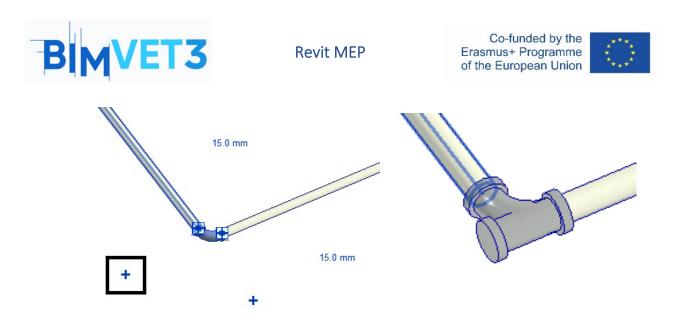


From the 3D view, with the Visual Style in Realistic option, when approaching the mouse to the other end, it is noticed that some connections remained with three outputs.

To remove one of the outputs, just click on the connection and then on the icon = . In this case, as it is a short, straight link, the link will be completely removed.



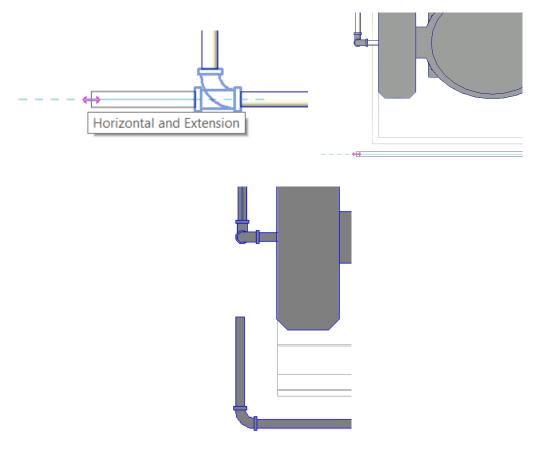
It may also be necessary to add one more outlet in some connections, such as the connection that will connect the new pipe to the toilet. To do this, click on the + icon in the desired direction.



In the Systems tab, select the Pipe tool and click on the new output created for the connection. In the Options Bar, enter the value of -0.20 in Middle Elevation.



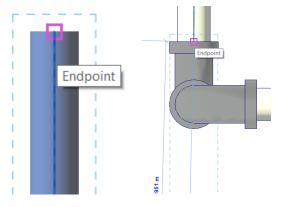
Drag the pipe from the connection outlet to the wall of the toilet connection, as shown in the following images.



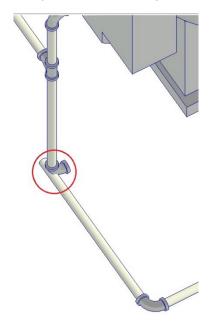




To align the pipes, just select one of them and in the Modify | Pipes select the Move tool . Select the point in the middle of the new pipe and then the middle point of the toilet pipe.



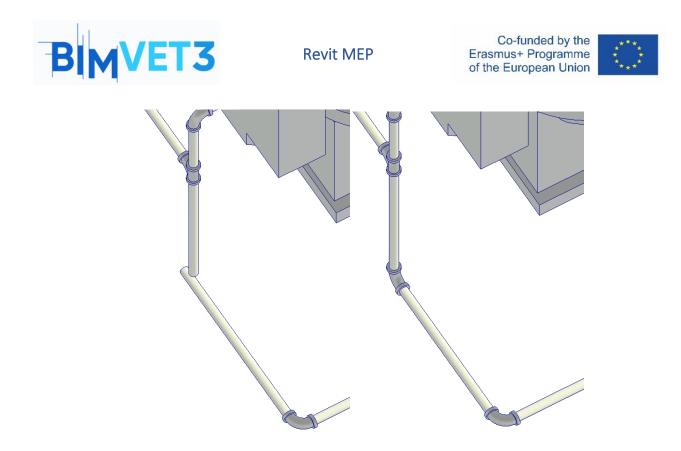
You must then select the connection and press the delete key.



To join the pipes, a very useful tool will be used to carry out these processes in Revit, which is the Trim/Extend to Corner tool This tool can be used whenever it is necessary to connect pipes. To do this, you must select one of the pipes and on the Modify | Pipe, select the Trim/Extend to Corner tool.



With the tool selected, just click on the two pipes and the connection will be added automatically.



The other equipment will also be connected in a more optimized way, such as the washbasins. This type of washbasin has a diameter of 25 mm for the inlet of cold water. You must change this measurement by clicking on the element and in the Properties Palette click on Edit Type.

Properties	×
	- Rectangular ) mm - Private
Plumbing Fixtures (1)	✓ 🔓 Edit Type
Constraints	* ^
Schedule Level	Ground Floor
Elevation from Level	0.8650 m
Host	Linked Revit Model : Proj
Plumbing	*
Flow Pressure	55158.000000 Pa
Mechanical	*
System Classification	Domestic Cold Water,Do
System Type	Domestic Cold Water
System Name	Domestic Cold Water
System Abbreviation	
Identity Data	*
Image	
Comments	×
Properties help	Apply



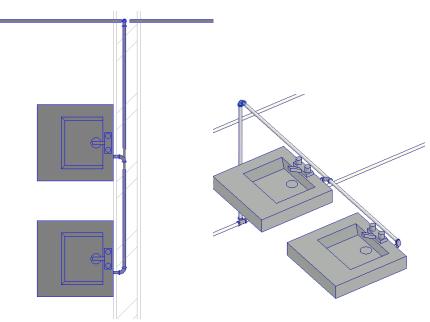


The type properties window will appear and the Cold Water Diameter parameter should be altered to 15 mm.

pe Propertie	S					$\times$
Family:	M_Lavatory - Rectangular		$\sim$	Load		
Туре:	560 mmx560 mm - Private		$\sim$	Duplicate		
				Rename.		
Type Paramet	ers					
	Parameter		Value		=	^
Constraints	;				^	
Default Elev	vation	0.8650 m				
Materials a	nd Finishes				\$	
Sink Materia	al	<by category=""></by>				
Faucet Mate	erial	<by category=""></by>				
Dimension	5				\$	
Sanitary Rad	dius	16.0 mm				
Sanitary Dia	meter	32.0 mm				
Sink Width		0.3810 m				
Sink Length		0.3050 m				
Lavatory Le	ngth	0.5600 m				
Lavatory Wi	dth	0.5600 m				
Hot Water F	Radius	7.5 mm				
Hot Water [	Diameter	15.0 mm				
Cold Water	Radius	7.5 mm				
Cold Water	Diameter	15.0 mm				
Mechanical					*	~
What do these	properties do?	ок	Cancel	Appl		

In the same way as was done with the bidet and the toilet, the two sinks will be connected to optimize the piping. Then the lavatory connections must be excluded and then new connections must be created

with the "In" tool  $\begin{tabular}{ll} \hline \begin{tabular}{ll} \hline \end{tabular}$  on the equipment.

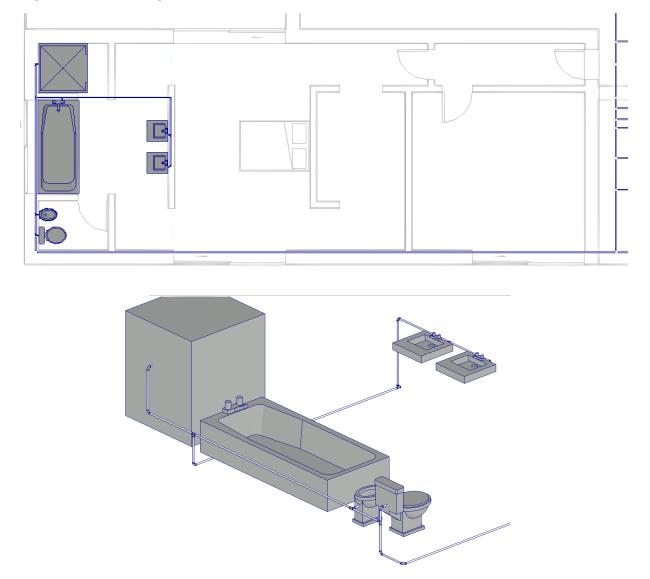








Using the tools mentioned above, connect the shower, bath, washbasins, bidet and toilet in a configuration like the images below.



It is recommended to make similar changes in other parts of the system, so that better solutions are created so that it is better distributed.

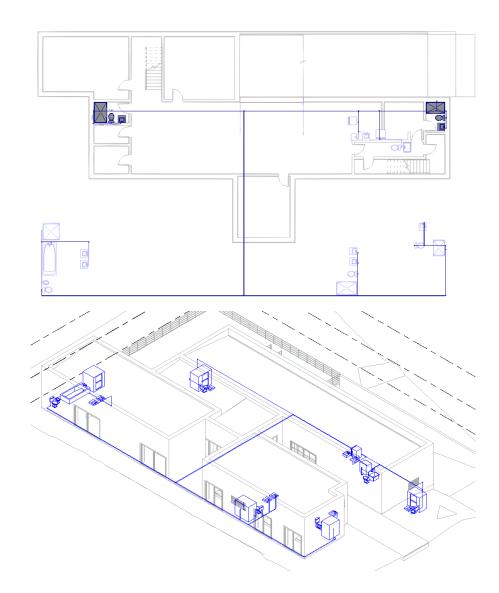
To assist in designing the system settings, you can open elevation views (Elevations) in the Project Browse, and create section views using the Sections tool on the Quick Access Toolbar.

One of the possible solutions may look like the images below.









With the Domestic Cold Water system already structured in the project, a pipe must be drawn to connect the system with the point of the public network. In this project, the location of the public network point is not represented, therefore, an approximation will be made.

The point at which the utility connection pipe will connect to the system is circled in Red in the image below.









To start designing the section connecting the public network, open the "2 – Plumbing" view, corresponding to the Ground Floor.

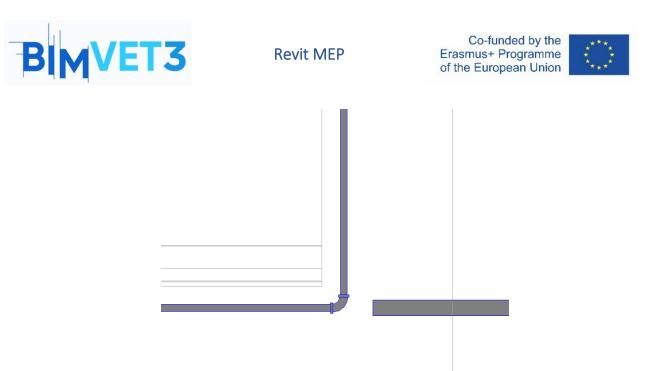
In the Systems tab, Plumbing & Piping panel, select the Pipe tool.



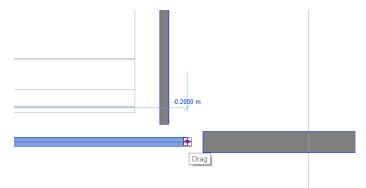
In the Options Bar, change the Diameter parameter to 40mm and Middle Elevation to -0.40m.

Modify   Place Pipe	Diameter:	40.0 mm	~	Middle Elevation:	-0.4000 m	~
modify [ made mpe	2.0.0000				1	

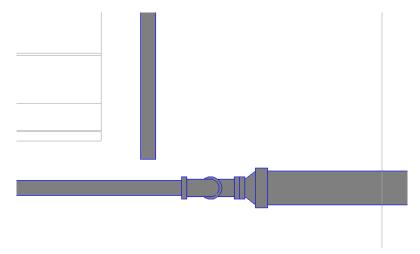
In the floor plan, bring the mouse cursor closer to the area circled in red in the previous image and trace a small stretch of pipe up to approximately half of the wall, as shown in the image below.



Delete the existing connection between the two pipes, click the end of the pipe horizontally and drag it to meet the new 40mm pipe.



A connection will be automatically created between the two pipes, with the diameter reducer (from 40 mm to 15 mm) coupled.

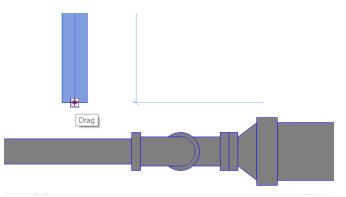




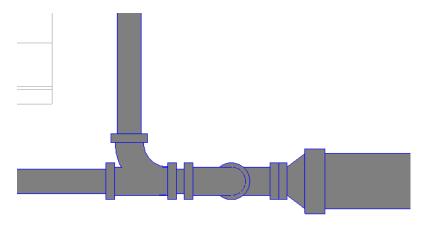




To reconnect the pipe in the vertical direction, click on it and drag it until it meets the pipe that was previously connected.



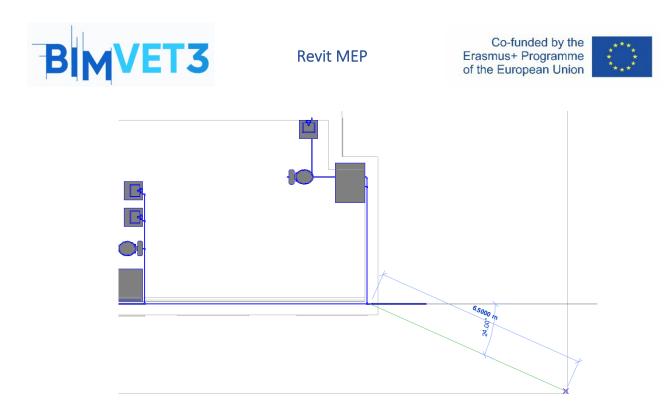
The connections in this area should look like the image below.



You must now drag the pipe to the boundary of the terrain. To do this, open the 3D view and in the view cube click on TOP, to view the drawing from above, as in a plan view. The difference is that in the 3D view it is possible to visualize the boundaries of the terrain.



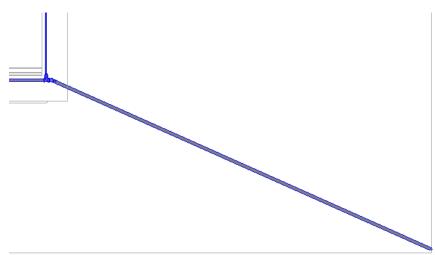
With this, click on the end of the 40mm pipe and drag it diagonally until it meets the boundary of the terrain.



After extending the pipe, click on it to select it. On the Modify | Pipes, Edit panel, select the Cap Open Ends option, to close the unconnected end of this pipe, as the connection to the public network is made by the local water company.



It should look like the image below.

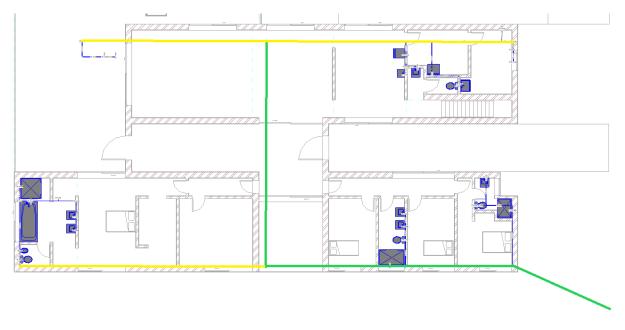




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After structuring the entire network, some changes must be made to the diameters and connections in some sections. In the image below, the sections that require a change in diameter are identified. The green sections should be changed to 40mm and the yellow sections to 25mm. The others must be kept with a diameter of 15 mm.



The change is made in a very simple way. Just click on the pipe to be changed and in the Options Bar (Modify Pipe) in the Diameter parameter, select the desired value (25mm or 40mm).



It is very important to verify that when changing the pipe diameter, the connection diameter was changed automatically. If it has not been changed, click on the connection and, in the Options Bar (Modify Pipe Fittings) in the Diameter parameter, select the desired value (25mm or 40mm).



# 5.6.3 Annotations

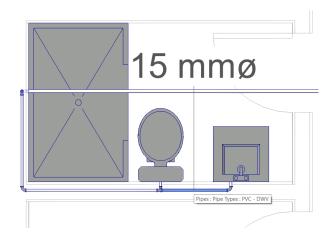
To insert annotation elements, such as pipe diameter identifiers, access the Annotate tab, Tag panel, and select the Tag by Category tool.







With the tool selected, move the mouse cursor closer to the element to be identified and the identification text will appear, with the diameter corresponding to the element. Position the text as desired and click on the element to insert the identification.



In this case, the text is too large for the scale of the drawing. To change the text size, double click on the text, and then the Modify | Label. Click once on the "Size" text to select it.

Size	

With the text selected, in the Properties Palette click on Edit Type.

Properties					Х
	Label 2.5				•
Pipe Tags (1)	)		$\sim$	🔠 Edit Ty	pe
Graphics				*	^
Sample Tex	t	Size			
Label			Edit		
Wrap betwe	een paramet				
Horizontal	Align	Center			
Vertical Alig	gn	Middle			
Keep Reada	able	$\checkmark$			
Visible		✓			
		^			~
Properties he	elp			Apply	

The Type Properties window will open, in which the Text Size parameter must be edited to 0,8 mm.





				×
Family:	System Family: Label	Load		
Туре:	2.5	~	Duplicate	
			Rename	
Type Paramete	irs			
	Parameter	Valu	e	=
Graphics				*
Color		Black		
Line Weight		1		
Background		Opaque	-	
Show Borde	r			
Leader/Bord	ler Offset	2.0320 mm		
Text				*
Text Font		Arial		
Text Size		0.8000 <mark>mm</mark>		
Tab Size		12.5000 mm		
Bold				
Italic				
Underline				
Width Facto	r	1.000000		

After editing the text size, in the Family Editor panel, click on the Load into Project icon.



A window will appear warning that the Family already exists. Click on the option "Overwrite the existing version".

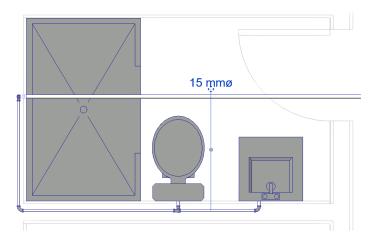
Family Already Exists	×
You are trying to load the family M_Pipe Size Tag, whi already exists in this project. What do you want to do	
ightarrow Overwrite the existing version	
ightarrow Overwrite the existing version and its parameter values	
Cancela	ar
Click here to learn more	

The text is now a more suitable size, if necessary, you can edit it again to make the text even larger or smaller.

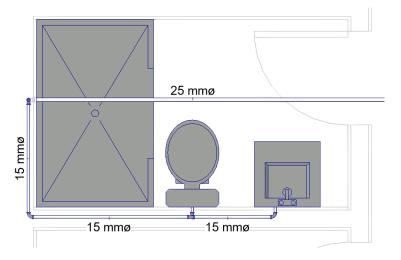




To drag the text to the pipe that it represents, click on the <sup>‡</sup> icon located just below the text, and drag it to the desired location.



Carry out the same procedure for all the pipes, so that it looks like the following image.



You can also use the Tag All tool, in the Annotate tab.



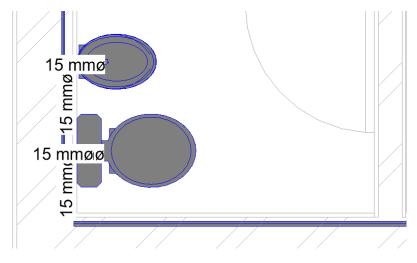
In the Tag All Not Tagged window, select the Pipe Tags option in the Category column.





Tag All Not Tagg	ed				$\times$
Select at least one non-annotated obje		0	r Symbol Family to	annotate	
All objects in cu	rrent view				
Only selected ol	bjects in current vi	iev	v		
Include element	ts from linked files				
Cat	egory		Loaded T	ags	^
Mechanical E	quipment Tags	M	_Mechanical Equ	ipment Tag :	
Nurse Call De	evice Tags	M_Nurse Call Devices Tag			
🗸 Pipe Tags		M_Pipe Size Tag			
Plumbing Fix	ture Tags	M_Plumbing Fixture Tag : Boxe			
Room Tags		M_Room Tag : Room Tag			
Security Devi	ce Tags	M_Security Devices Tag			
Space Tags		M_Space Tag : Space Tag			
Sprinkler Tag	S	M_Sprinklers Tag			
Telephone D	-	M_Telephone Device Tag			
Tage Tiel		M	Wall Tag · 12mr	n	*
Leader	Leader Length	:	12.7 mm		
	Tag Orientation	:	Horizontal $\sim$		
ОК	Cancel		Apply	Help	

By clicking OK, the identifications are added to all existing pipes in the project. However, many texts end up overlapping and manual adjustments must be made anyway.



## **5.6.4 Create Schedules**

Creating tables for Revit MEP is done in the same way as for Revit Architecture. What changes is the information displayed in each type of table. As an example, a table will be created with information about the pipes.

To start creating a table, in the Project Browser, in Schedules, right-click and then select the "New Schedule/Quantities" option.





	New Schedule/Quantities			
Properties help Project Browser - MEP automation 	New Graphical Column Schedule New Material Takeoff			
	New Sheet List New Note Block New View List			
	Browser Organization			
	Search Expand All Collapse Selected			
Legends	Collapse All			
<ul> <li>Schedules/Quantities (a)</li> <li>Space Outdoor Air Schedul</li> <li>Sheets (all)</li> <li>Families</li> <li>Groups</li> <li>Detail</li> <li>Model</li> </ul>				

Then in the New Schedule window, under Category, select the Pipes option. In Name, you can change the name of the table. In this case, Pipe Schedule will be kept.

New Schedule		×
Filter list: Piping ~		
Category:		Name:
	^	Pipe Schedule
MEP Fabrication Pipew Model Groups Parts Pipe Accessories Pipe Fittings Pipe Insulations Pipe Placeholders Piping Systems Plumbing Fixtures Rooms RVT Links	~	Schedule building components Schedule keys Key name: Phase: New Construction
< >>		
0	K	Cancel Help

In the Schedule Properties window, in the Fields tab, select the following parameters for the table: Connection Type, Diameter, Flow, Length, Material, System Name, Top Elevation and Velocity.





Schedu	le Prop	erties					$\times$
Fields	Filter	Sorting/Grouping	Formatting	Appearance			
Pipes Availa	ble field		~	_	Scheduled fields (in o	order):	
Asser Asser Botto Comr Cost Coun Critic Descr Famil Famil Fixtur Flow Frictir IfcGU	al Path ription ly ly and Ty re Units State on State on Facto ID	le scription ne ion /pe		↓ ↓ <i>fr</i>	Connection Type Diameter Flow Length Material System Name Top Elevation Velocity		
	<b>X</b> 1	ments in links			// ₩i - t는 k		
				[	ОК С	Cancel H	elp

By clicking OK, the table will be created with all the information that was selected. If any changes are made to the project, the table is automatically updated, and vice versa.





<pipe schedule=""></pipe>							
Α	B	С	D	E	F	G	H
Connection Type	Diameter	Flow	Length	Material	System Name	Top Elevation	Velocity
Generic	15.0 mm	0.9 L/s	0.38 m	Polyvinyl Chloride -	Domestic Cold Water	0.22 m	4.8 m/s
Generic	15.0 mm	0.0 L/s	3.55 m	Polyvinyl Chloride -	Domestic Cold Water	-0.19 m	0.0 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.27 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.87 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.93 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.87 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.93 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.04 m	Polyvinyl Chloride -	Domestic Cold Water	0.48 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.04 m	Polyvinyl Chloride -	Domestic Cold Water	0.93 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.87 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.93 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.50 m	Polyvinyl Chloride -	Domestic Cold Water	2.36 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.59 m	Polyvinyl Chloride -	Domestic Cold Water	0.43 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.48 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.87 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.03 m	Polyvinyl Chloride -	Domestic Cold Water	0.93 m	4.8 m/s
Generic	40.0 mm	1.9 L/s	14.02 m	Polyvinyl Chloride -	Domestic Cold Water	-0.18 m	1.5 m/s
Generic	15.0 mm	0.9 L/s	0.06 m	Polyvinyl Chloride -	Domestic Cold Water	0.48 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.07 m	Polyvinyl Chloride -	Domestic Cold Water	0.27 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.04 m	Polyvinyl Chloride -	Domestic Cold Water	0.82 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.04 m	Polyvinyl Chloride -	Domestic Cold Water	0.82 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	1.76 m	Polyvinyl Chloride -	Domestic Cold Water	0.82 m	4.8 m/s
Generic	15.0 mm	0.9 L/s	0.93 m	Polyvinyl Chloride -	Domestic Cold Water	0.77 m	4.8 m/s
Generic	15.0 mm	0.0 L/s	0.37 m	Polyvinyl Chloride -	Domestic Cold Water	-0.19 m	0.0 m/s
Generic	15.0 mm	0.0 L/s	0.38 m	Polyvinyl Chloride -	Domestic Cold Water	0.22 m	0.0 m/s
Generic	15.0 mm	0.9 L/s	0.15 m	Polyvinyl Chloride -	Domestic Cold Water	0.43 m	4.8 m/s
Generic	15.0 mm	0.0 L/s	3.04 m	Polyvinyl Chloride -	Domestic Cold Water	0.27 m	0.0 m/s
Generic	15.0 mm	0.0 L/s	0.49 m	Polyvinyl Chloride -	Domestic Cold Water	0.27 m	0.0 m/s
Generic	15.0 mm	0.9 L/s	0.57 m	Polyvinyl Chloride -	Domestic Cold Water	0.87 m	4.8 m/s
Generic	15.0 mm	0.0 L/s	0.38 m	Polyvinyl Chloride -	Domestic Cold Water	0.22 m	0.0 m/s
Generic	15.0 mm	0.9 L/s	0.84 m	Polyvinyl Chloride -	Domestic Cold Water	0.27 m	4.8 m/s
Generic	40.0 mm	0.0 L/s	6.77 m	Polyvinyl Chloride -	Domestic Cold Water	-0.38 m	0.0 m/s

## **5.6.5 Create Isometric Views**

For a better representation of the project, isometric views of the network can be created. To position the drawing in an isometric view, just open the 3D view and click on one of the corners of the cube, as shown in the blue area in the image below.

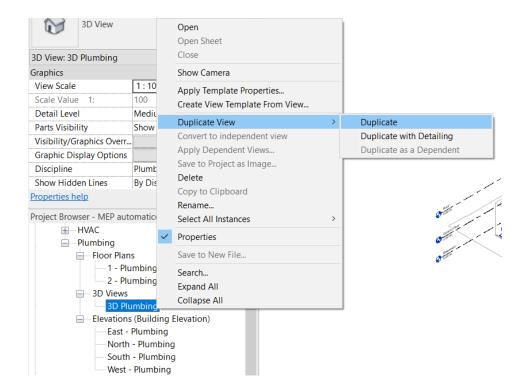


To create a general isometric view of the network, you must first duplicate the 3D view. To do this, in the Project Browser, right-click on the 3D Plumbing view, then on Duplicate View and then on Duplicate. Rename the view to "Isometric Plumbing".

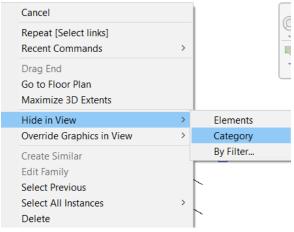
## BIMVET3

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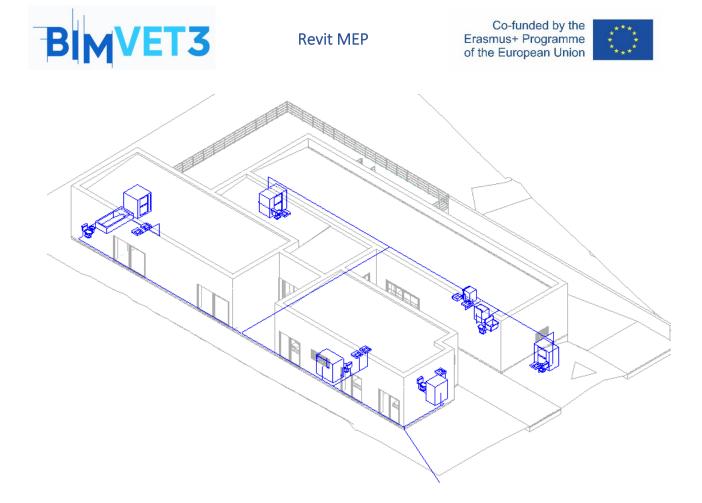




Levels will not be needed in this view, so you can hide them. To do this, click on one of the levels with the right mouse button, click on Hide in View and select the Category option.



With the isometry positioned according to the image below, the position will be fixed.



To fix the position, in the visualization bar, just click on the final Locked 3D View icon, and select the option Save Orientation and Lock View. The view then cannot be rotated.



It is important to define the cropping region of the view, so that when it is inserted into a sheet for printing, it is already adjusted. To do this, click on show Crop Region on the visualization bar.

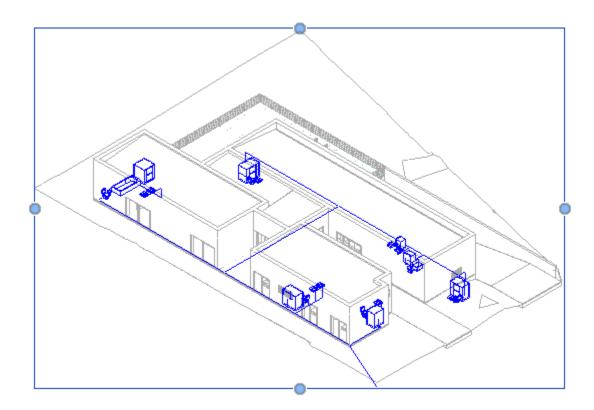


The rectangle with the clipping region will be displayed. Click on the rectangle and adjust it so that it is very close to the limits of the drawing, as shown in the image below.









After adjusting the cropping region, on the Preview Bar, select the Hide Crop Region option to hide the cropping region.

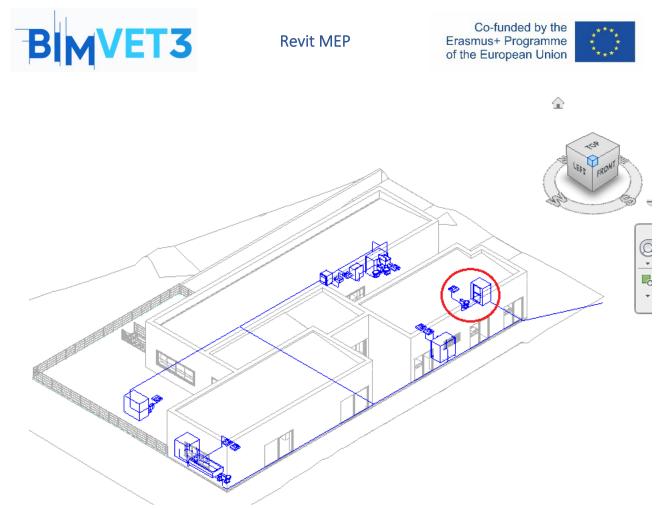


The general isometric view is created. Now an isometric view of a bathroom will be created. To do this, duplicate the "Isometric Plumbing" view and rename it to "Isometric Plumbing Bathroom".

With the "Isometric Plumbing Bathroom" view open, click on the ..., Unlock 3D View icon and select the Unlock View option to allow the 3D view to be moved again.



Rotate the 3D view through the corners of the visualization cube, until reaching the view as shown in the following image. Once positioned, click on the Cocked 3D View icon again. The red circle represents the environment for which the isometric view will be created.



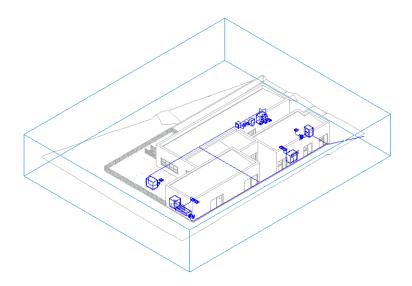
To cut the isometric view only from the desired environment, you can use the Section Box tool. To enable it, just check the Section Box option in the view's Properties Palette.





Properties			>	<
	3D View			•
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Detail Leve		Medium		
Parts Visibil	ity	Show Original		ĺ.
Visibility/Gr	aphics Overr	Edit		
Graphic Dis	play Options	Edit		
Discipline		Plumbing		
Show Hidde	en Lines	By Discipline		
Default Ana	alysis Display	None		
Sub-Discipl	ine	Plumbing		
Sun Path				
Extents		······	*	
Crop View				
Crop Regio	n Visible			
Annotation	Crop			
Far Clip Act	ive			
Far Clip Off	set	304.8000 m		
Scope Box		None		
Section Box	(	$\checkmark$		
Camera			*	
Rendering S	Settings	Edit		,
Properties he	elp		Apply	1

A Selection Box will then appear, which you can adjust to crop only the desired environment.

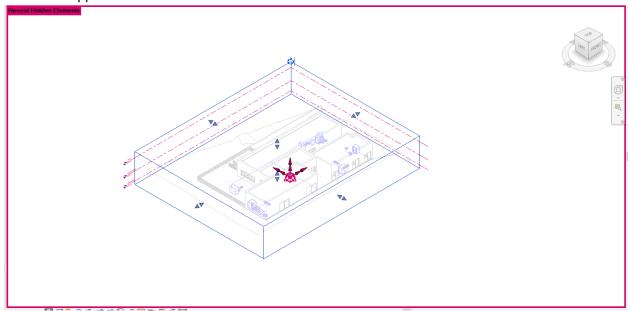




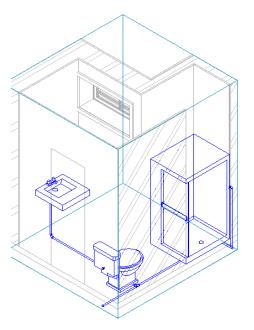




Note: If the Check Box is not visible, click on , Reveal Hidden Elements in the visualization bar and then it will appear.



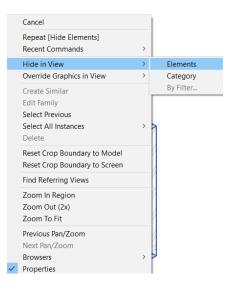
Using the arrows of the Selection Box, you must drag them or click in the direction in which you want to move the Box limit, until you get a result similar to the image below.



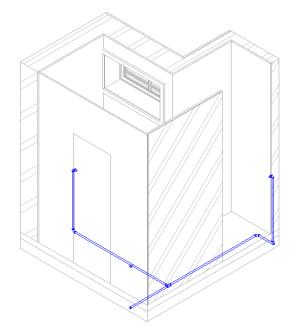
To hide the Selection Box, right-click on it, click on Hide in View and select the Elements option.







The same can be done for the plumbing fixtures (sink, watercloset, shower) if you want only the pipes and connections to appear in the isometric view, as in the image below.



## 5.6.6. Create Sheets

The creation of sheets for printing is done through exactly the same procedure described in the architectural model tutorial (see item 5.11 of the Revit Architecture tutorial). In this case, following the same instructions, you must create one or more sheets that contain the two plan views and the two isometric views that were created in this tutorial.