Fast Track for Autodesk® AutoCAD® MEP Power Users

David Butts – Gannett Fleming

MP1523-L

Being an Autodesk® AutoCAD® Architecture or Autodesk® AutoCAD® MEP user is like being a younger sibling of an over-achieving brother or sister. However, we've got some tricks up our sleeves and AutoCAD has some tools and features that the Autodesk® Revit® world doesn't have yet. In this hands-on lab, we cover tips for creating and maximizing projects using AutoCAD Architecture, Revit, or plain AutoCAD for MEP design; key features for AutoCAD MEP users that aren't available in Revit MEP; using MEP models for energy analysis and other external applications; and creating custom content quickly for 3D projects. Join us for this information-filled class that helps you be competitive in the BIM world, featuring the longest-tenured MEP modeling product in the Autodesk lineup. And get your hands on some of my tools to help you get started.

Learning Objectives

At the end of this class, you will be able to:

- List key components and features to use in a Project Navigator-based project
- Describe key platform-specific features and workflows available in AutoCAD MEP
- Make full use of MEP models for external analysis applications, such as Autodesk® Green Building Studio®, Project Vasari, and more
- Apply tips for creating and managing custom AutoCAD MEP block-based and parametric content

About the Speaker

David is a BIM Specialist for Gannett Fleming, a multi-discipline engineering firm based in Camp Hill, PA, with 60 offices in the US and overseas. Based in the Raleigh, NC office, he provides BIM Implementation and training for the firm's engineering design software, including Revit, Navisworks, AutoCAD MEP/P&ID and more. He has 28 years of experience in both the design and Autodesk VAR channel, spending 13 years working as an instructor and consultant for the Autodesk building design product line. David also worked as a training manager while in the channel, and was a member of the Autodesk ATC Advisory Board for 2009-10. He is a Revit Architecture Certified Professional, and also earned the MEP Implementation Certified Expert title. David has spoken at AU for several years, and was named the Top Speaker for both labs and lectures at AU 2011. As an author, he also contributes to 4D Technology's CADLearning training programs and has written several training manuals for Revit MEP.

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Introduction

I'm a lucky guy...my career runs parallel to the guy who's dad owns the toy store. I get to try out and break everything, to see how well it will sell – and how it will make us money. For me, that means spending a lot of time with a variety of design applications, including AutoCAD MEP and Revit MEP, among several others. Every project that I've worked on for the past three decades has minor variations in how it's defined, and how the tools are used.

For engineering firms that use AutoCAD MEP that could be a wide open statement, since the beauty – and weakness – of AutoCAD is the variety of approaches that can be used. But when you're working in a modeling environment versus a drafting exercise, you need to adjust your workflow and design processes accordingly. In this lab, we're going to take a look at some of the more obscure items that can either cause you fits, or really make your life easier when using this tool. Let's get rolling…

Getting the Most from Project Navigator in AutoCAD MEP

In our first exercise, we're going to take a look at getting the most from Project Navigator in the MEP environment. The example is based on a combined sewer overflow project we designed in the last year. While this sample is not identical to the original, it should give you an idea of how this approach will work, if you're using AutoCAD MEP. One important note – the steps in this process are similar to how I would setup a multiple structure/building site in Revit.

Bases – UCS's – Rotated Views – and Levels!

When you are working on a typical building design, there are a couple of different approaches you can take. The first, and more traditional method, is to create a drawing base file for each building, with a specific corner of the building at a 0,0 insertion point. This base typically represents a 3'-4' cut plane above a specific floor level. When you're working in a disconnected environment, where items aren't connected across a site, this works well. But the majority of projects we've worked on the past few years have included multiple buildings or structures, so we changed our work process.

For example, a water treatment plant usually contains several smaller structures that are interconnected by piping, conduit, etc. The invert elevations and connection points between the buildings are critical, so making sure everything lines up takes precedence. And by the way – not everything you use in Project Navigator has to be a Project-specific tool. There's a lot of cool AutoCAD tricks you can leverage in the project environment.

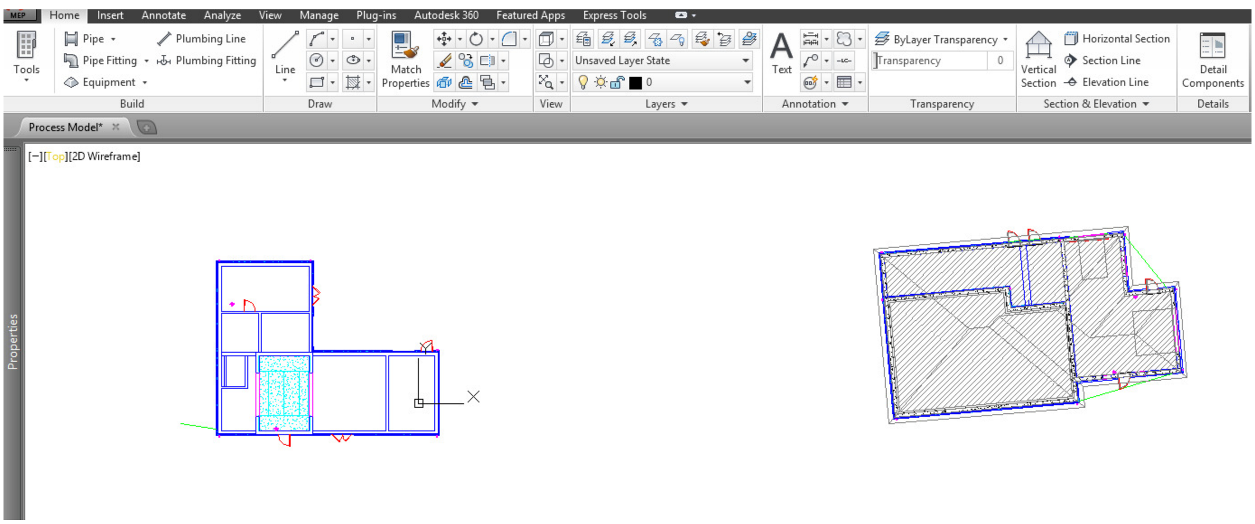
So how would I define this project?

When you're working on a site-specific project, nothing is ever at true ortho angles, so you have to know how to put all of this together. Let's start by looking at our sample project. Instead of using separate files for each building, where I've created the two buildings in the same file.

Exercise 1: Reviewing the Base Plan Setup

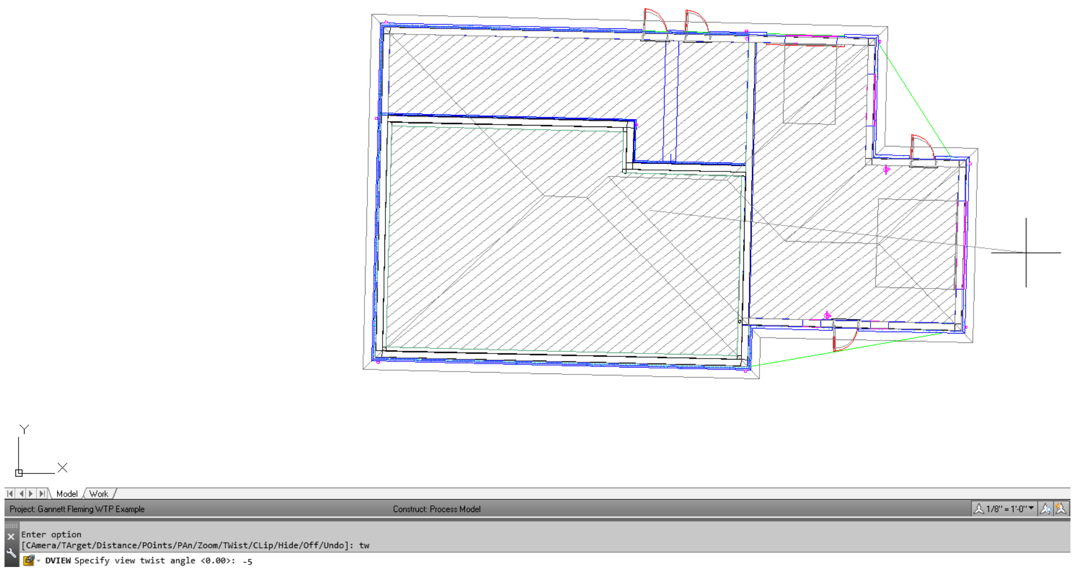
To begin this exercise:

1. Make sure the **Gannett Fleming WTP Example** is the current project.
2. From the **Constructs** tab, **Process** category, open the **Process Model** construct.
3. There are two buildings in this construct. Note that they are NOT co-planar (a $10 word that means they don't line up).

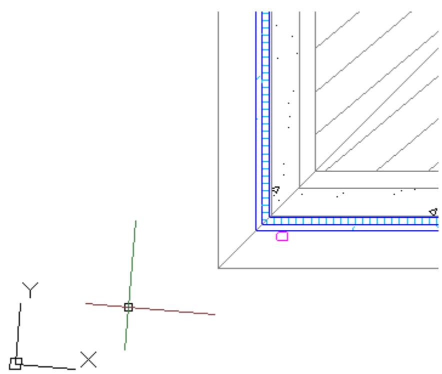


This view is designed as an overall representation of buildings that start from the same finish floor elevation. Drawing orthographic linework is still constrained by the UCS axis and the view rotation, so let's fix the chemical building orientation to draw piping at right angles to the building.

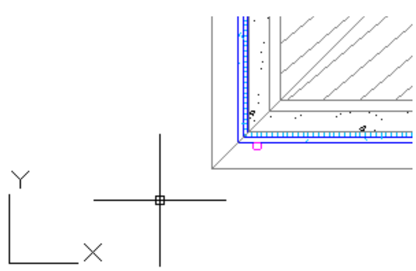
4. From the command line, enter **DV** for DVIEW. When prompted, select the linked architectural drawing.
5. Enter **TW** to twist the view. Enter **-5** for the rotation angle (I've cheated, and already determined the angle difference from the XY plane). Press **ESC** to clear the command, after the view is rotated.



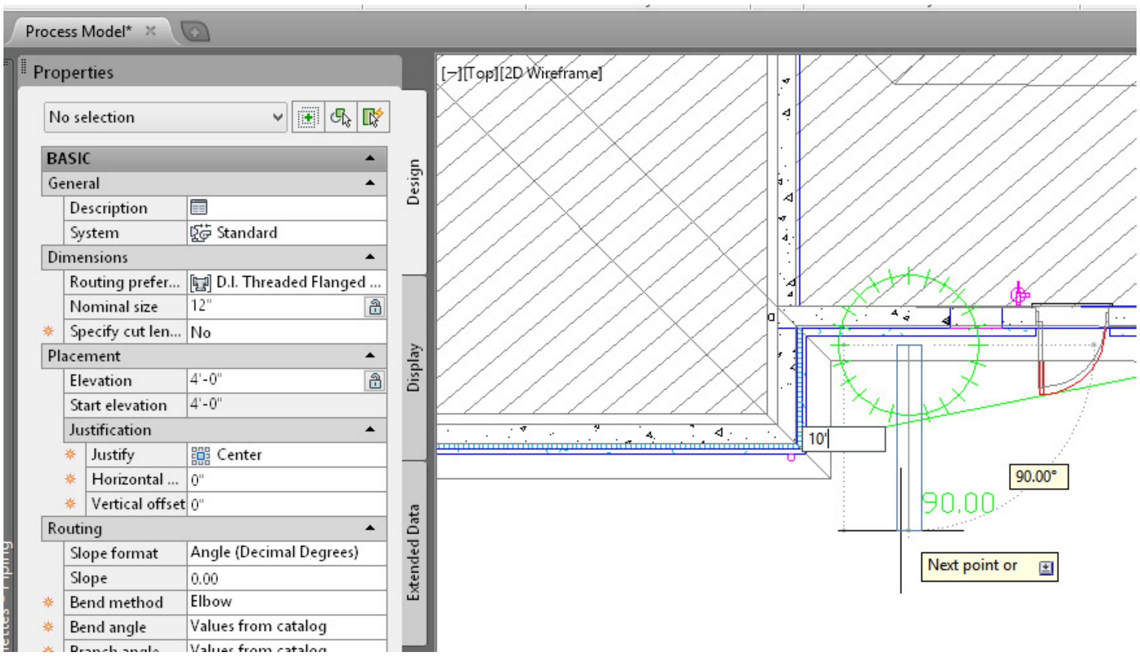
6. The chemical treatment building is now flat, but the XY axis is still set to the original world coordinates.



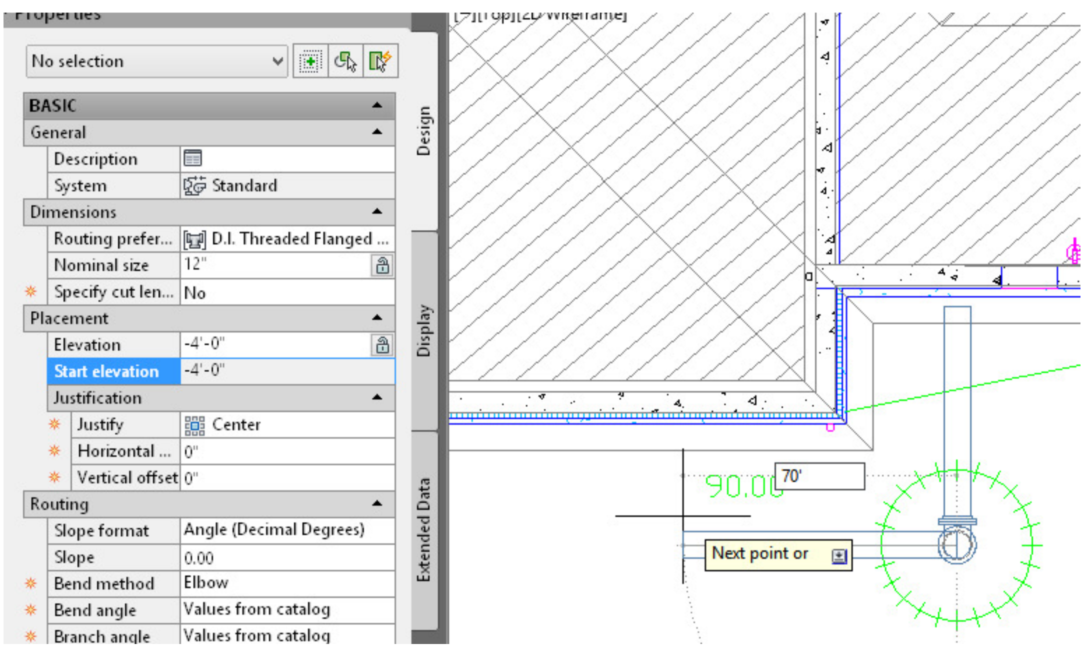
7. From the command line, type **UCS** and press enter.
8. When prompted, type **V** and press enter. The UCS axis is now oriented to this view, to allow the correct placement of pipe relative to the building.



9. From the **Home** tab, select the **Pipe** command from the Build panel.
10. On **Properties**, set the routing preference to **DI Class 250**, the size to **12"** and the elevation to **4'.** (Note: the elevation is relative to the XY axis elevation in this drawing). Draw a segment down away from the building 10':

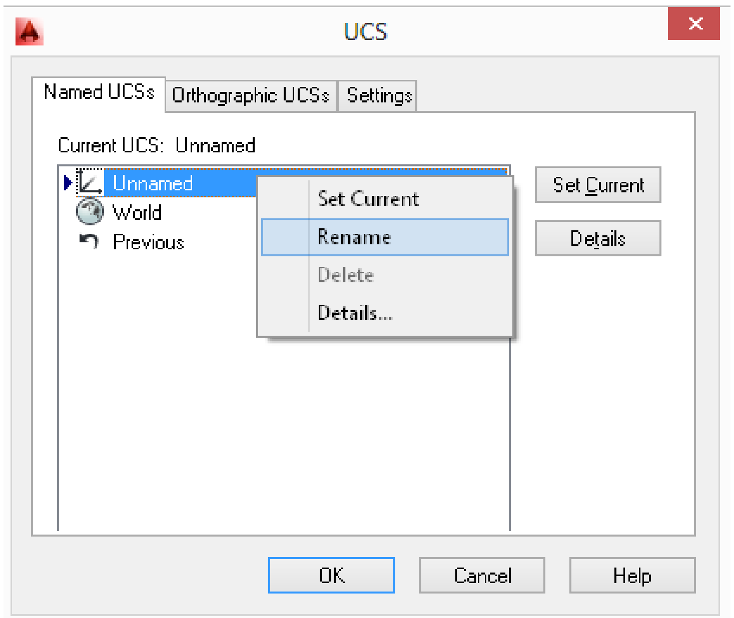


11. From properties, change the elevation to **-4'**. Draw another pipe segment to the left about **70'**, and press **ENTER** when complete.

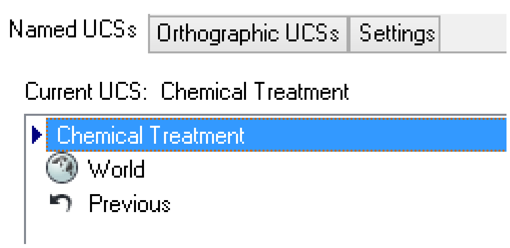


One other option I like to take advantage of the easy way to add a UCS. Now that we have building oriented the way we want, let's save this orientation so it can easily switched.

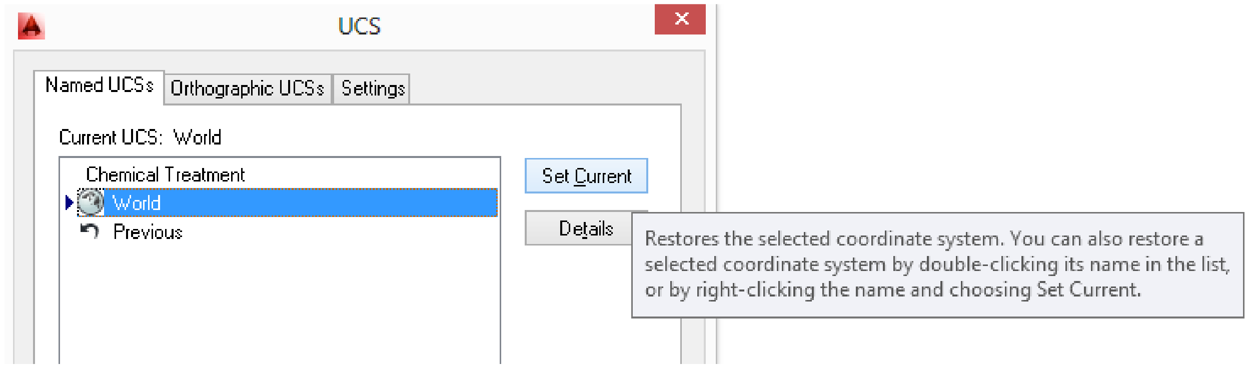
12. From the command line, type **UCSMAN** to open the UCS Manager.
13. The current UCS will appear as **Unnamed**. Right click and select **Rename** on the Named UCS's tab.



14. Name the current UCS **Chemical Treatment**. Click OK to complete the command.

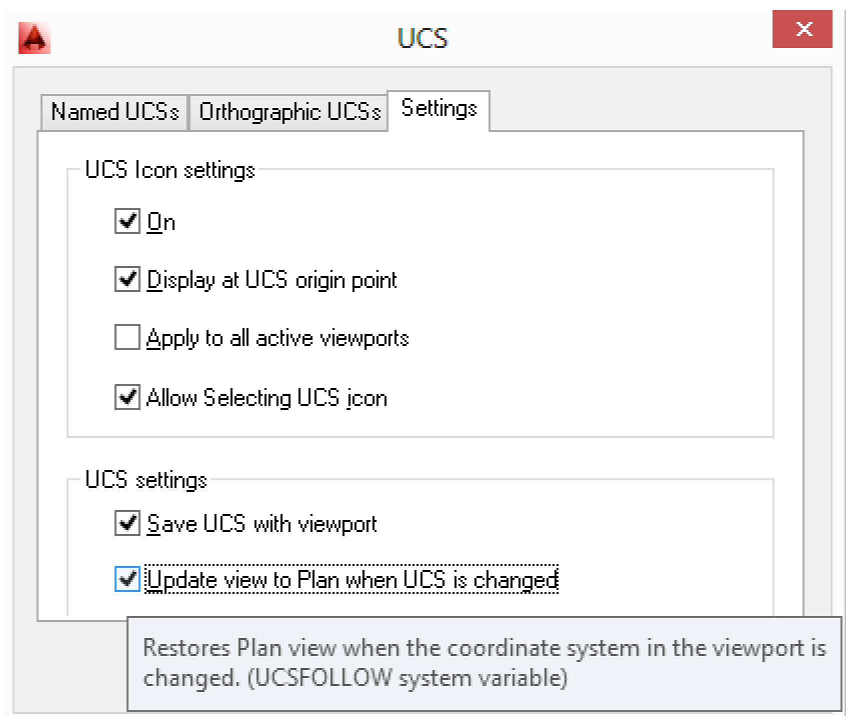


15. Now, change the UCS to **World**. While the view won't twist by default, the coordinate system will align with original building.

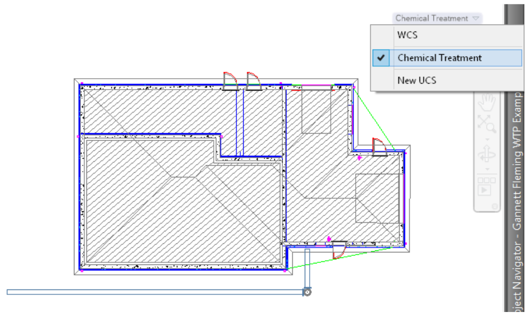


To make the view rotate when changing UCS's, open the **UCS Manager** tool again.

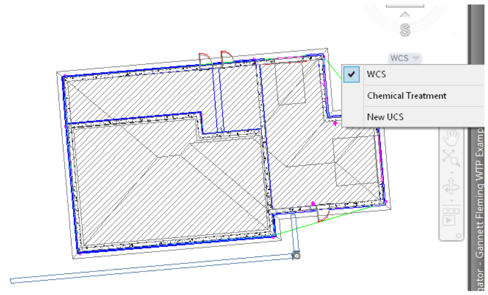
16. Click **Settings**. Under **UCS Settings**, select **Update View to Plan when UCS is changed**.



17. Click **Ok**. Alternate the two UCS settings, and note how the views rotate.



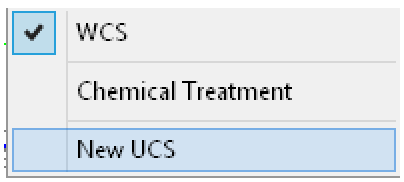
Chemical Treatment



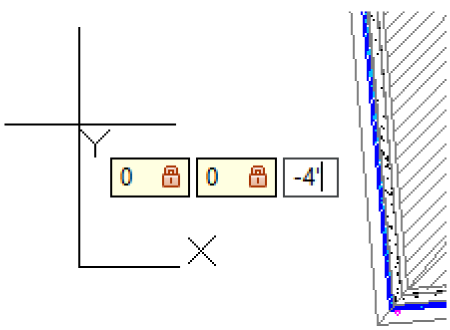
WCS

Here's another trick. Make sure the **Chemical Treatment** UCS is the current UCS.

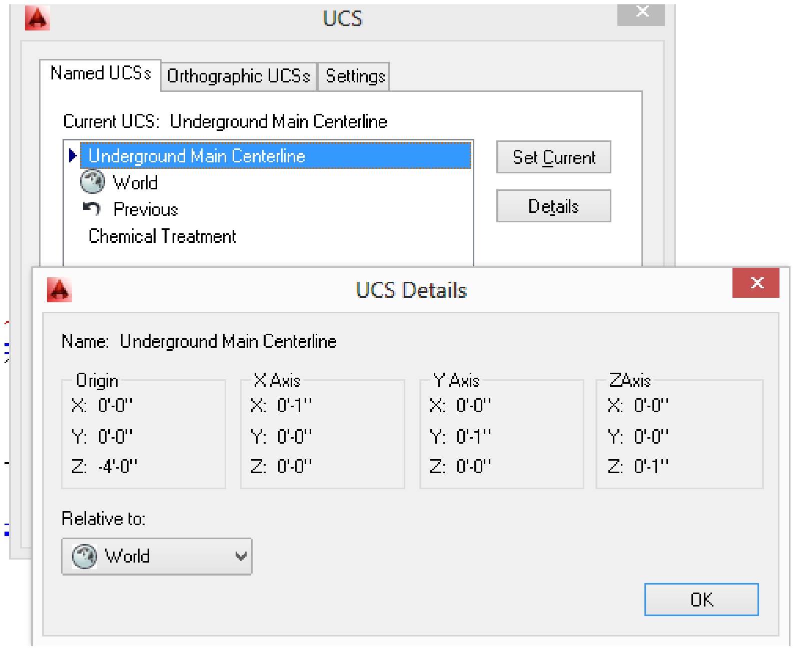
18. On the **View Cube**, select the **UCS** drop down. Select **New UCS**.



19. When prompted to specify the origin, enter **0,0,-4'**.



20. When prompted to specify a point on the X axis, make sure **Ortho** is enabled, and select a point towards the **right**. Press **Enter twice** to complete the command.
21. A new **Unnamed** UCS appears. Return to the UCS manager, and rename it to **Underground Main Centerline**. Click OK to complete the command.

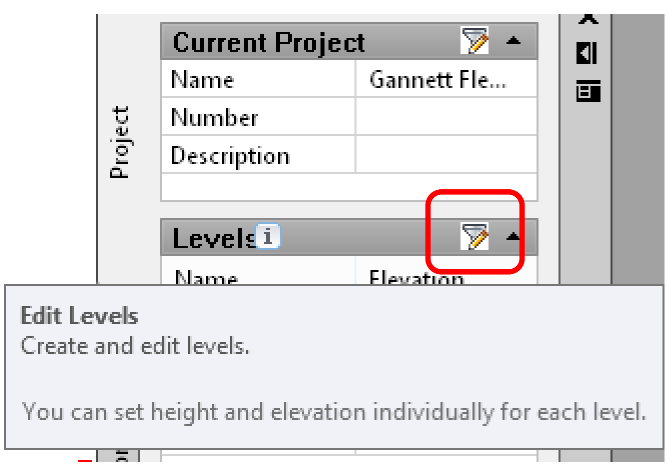


22. Let's add another pipe. Select the last pipe segment drawn, and then click **Add Selected**. This will map the same properties used to start the new pipe, but take a look at the elevation. Instead of 4' as originally selected, it's now at 8'.

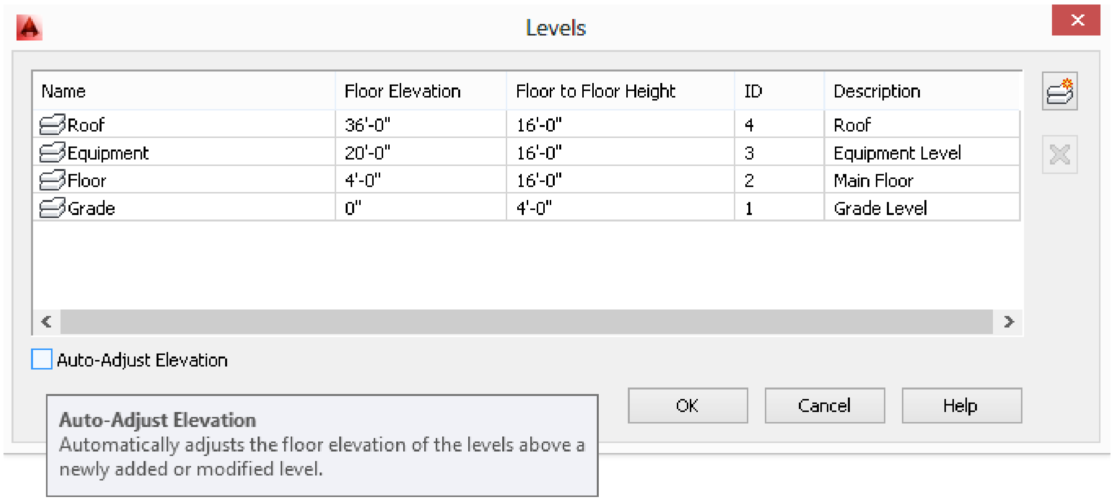
Why is this important? Simple – if you are routing pipe that needs to be based on a real world elevation, but you are working with an existing project that was created at a "0" elevation, the new UCS can be used to correct this. As long as you know the difference in elevation of the current level, and the real world elevation, you can make this simply change without rebuilding the model.

Let's take another approach, and learn how to add levels at varying elevations in a project.

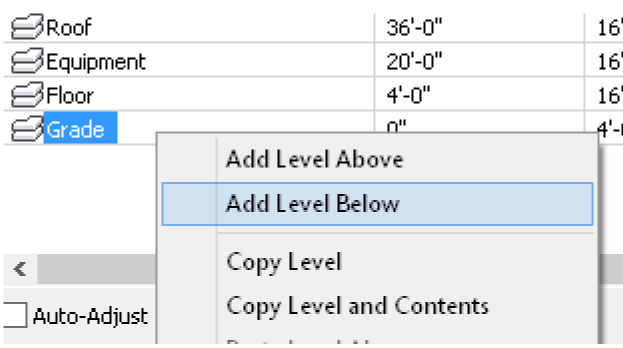
1. From the **Project Navigator**, select the **Project** Tab. Click **Edit Levels**.



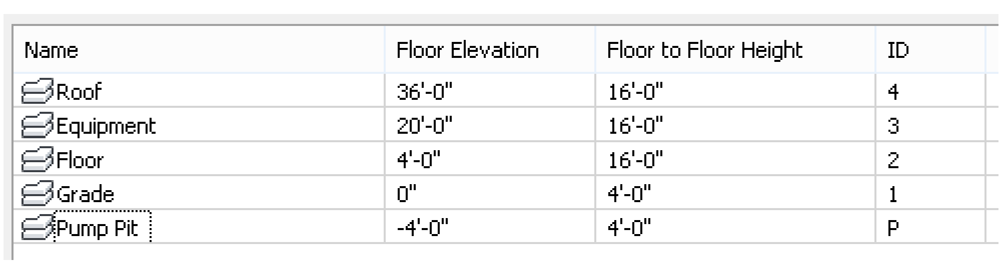
2. Note the different elevations that are already assigned, and available for use on any drawing in the project. To add a lower level, start by deselecting the **Auto-Adjust Elevation** tool.



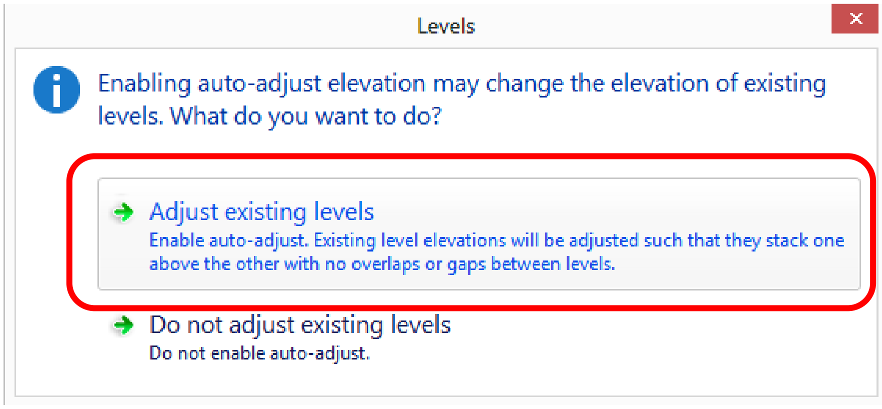
3. Select the **Grade** level, and then right click. Select **Add Level Below**.



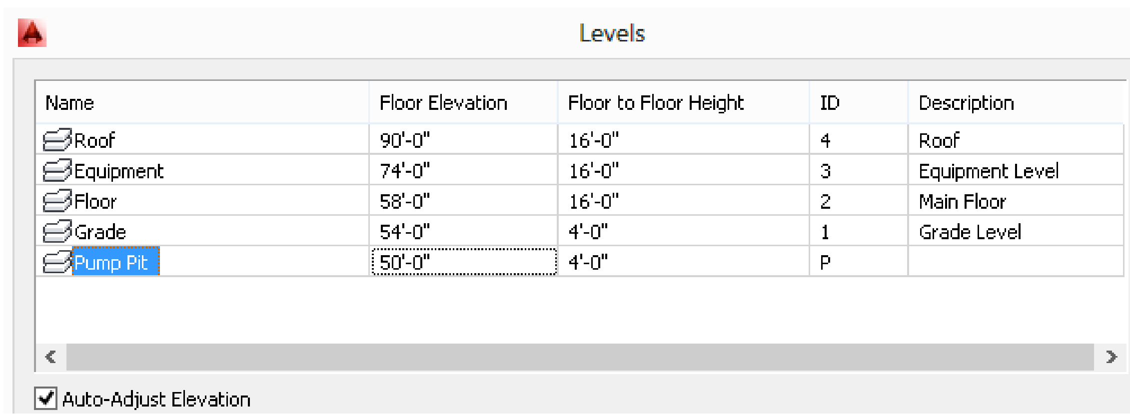
4. The new level will be added, with a number for the name. Change the name to **Pump Pit**.



5. Select **Auto-Adjust Elevation**. A dialog about adjusting existing levels will occur. Select **Adjust existing levels**.



6. Change the **Pump Pit** elevation to **50'**. Note how all elevations are now adjust upward.



Name	Floor Elevation	Floor to Floor Height	ID	Description
Roof	90'-0"	16'-0"	4	Roof
Equipment	74'-0"	16'-0"	3	Equipment Level
Floor	58'-0"	16'-0"	2	Main Floor
Grade	54'-0"	4'-0"	1	Grade Level
Pump Pit	50'-0"	4'-0"	P	

This tool will help you move items in your project up to real world elevations. The advantage of this method is that it also adjusts the elevation of all objects in a model file to reflect the new elevation. To test this, click OK to exit the dialog. Select Yes when prompted to regenerate all views in the project.

While building and corresponding models will be correctly located in a combined model, at the correct elevation, the UCS settings remain unchanged. Why?

Because the UCS is relative to the current drawing, not to the project's overall elevations.

Having the different UCS types included in your construct helps smooth model alignments for piping and other MEP components. You can also repeat this step in a view drawing, and add your tags, dimensions and text. This will help keep annotations aligned with the view orientation. But when you want to work at real world elevations, make sure you define the correctly in Project Navigator first. You'll find that moving items vertically is really easy in AutoCAD MEP – even easier than editing levels in Revit!

Leveraging AutoCAD MEP to Assist Project Workflows

I've been a big fan of the schematic drafting tools in AutoCAD MEP for years. I've used them on almost every project I've worked on. When I started my current position, I found that we still depend heavily on CAD customizations and symbology that was focused more on layer control that improving work process.

This year, we began a sub-implementation of AutoCAD MEP for several reasons. One was review projects that were still based in plain AutoCAD, and learn how to leverage MEP tools to improve production on projects where the architecture and structure was still being completed in 2D. The more interesting project was learning how to leverage the schematic tools to get a better understanding of object based programming, and use it for applications like Revit that don't offer these tools. We also were studying how to associate information with a schematic representation of an electrical or plumbing schematic and associate it with-BIM object data in Revit. In this exercise, we'll take a look at these two approaches.

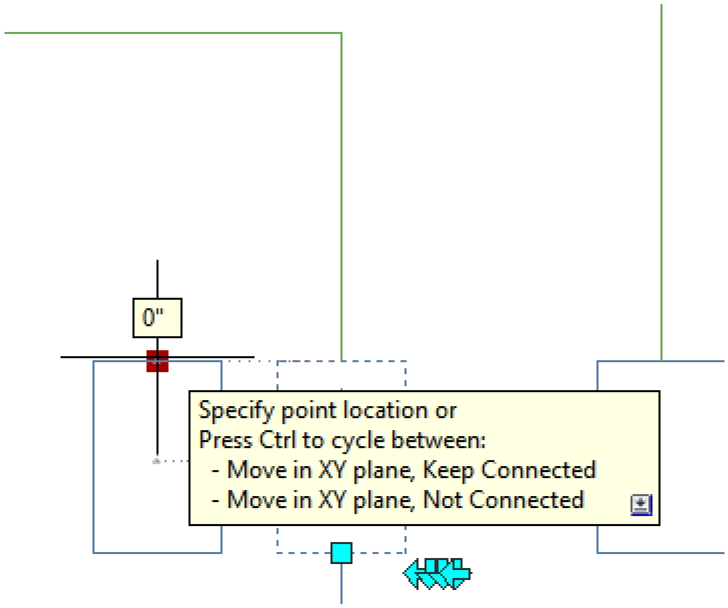
Exercise 2: Leveraging AutoCAD MEP Schematic Tools

To begin this exercise:

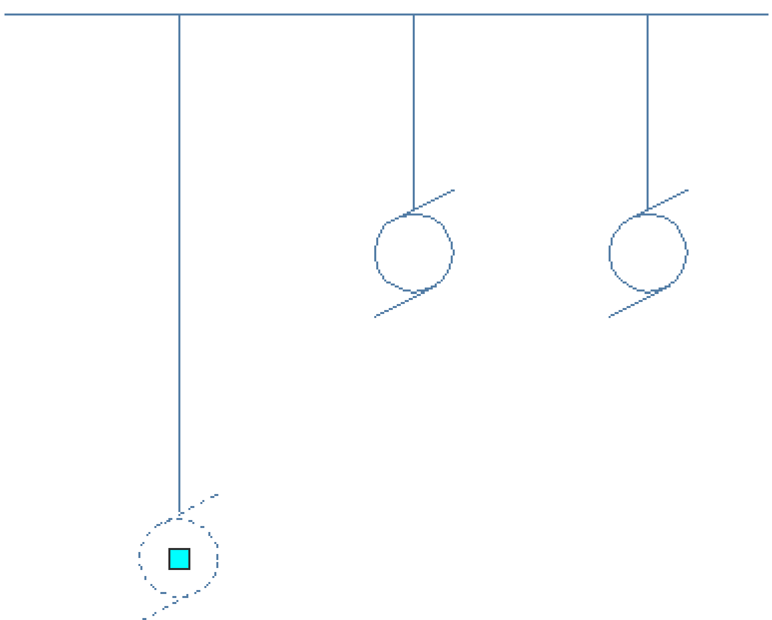
1. Make sure the **Gannett Fleming WTP Example** is the current project.
2. Set the **Schematic** workspace current.
3. From the **View** tab in Project Navigator, open the **Power Riser Diagram**. Review the basic symbols that have been placed in the drawing.

Schematic symbols and linework have a "symbiotic" relationship with each other. I also refer to this as the "sibling" relationship. In other words, you can't do something to one without it having an effect on another.

1. Select the first panel. Click on a **grip**, and then drag the panel to the left. Note how the schematic line moves with the panel.

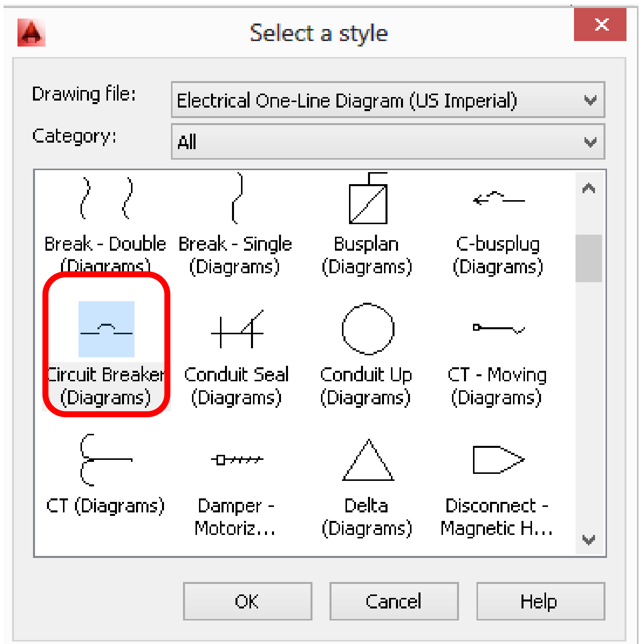


2. Repeat this step with a motor, dragging it down to add a little room on the schematic line.

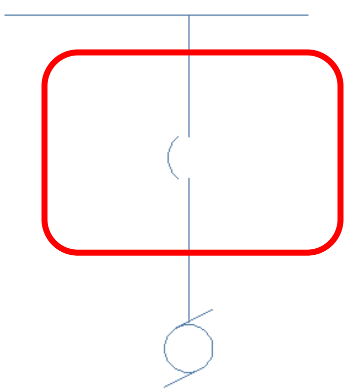


3. From the ribbon, **Home** tab, **Build** panel, click **Schematic Symbol**.

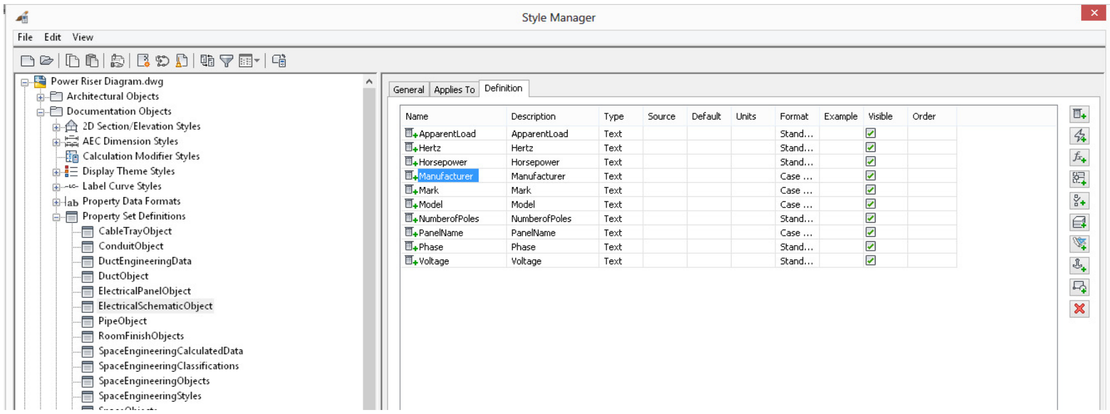
4. On the properties palette, select the **Symbol** tool. Locate the **Circuit Breaker**, and then click OK.



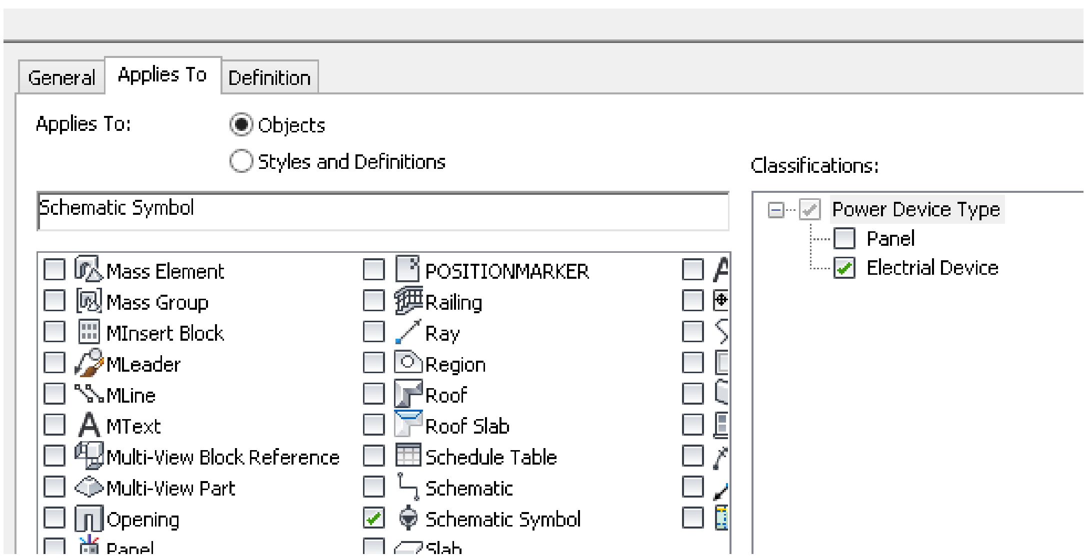
5. Locate the breaker along the schematic line.



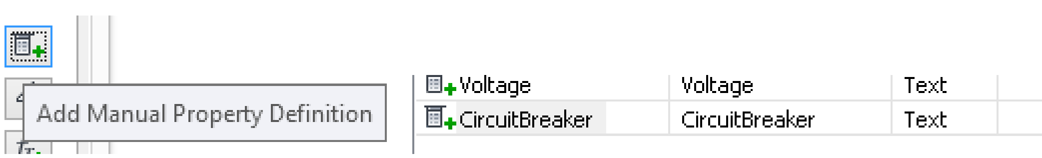
6. Let's create a few property set definitions that can be used to replace text that normally would be used to label the circuit. From the **Manage** tab, click **Style Manager**.
7. Under **Documentation** objects in the current drawing, click **Property Set Definitions**.
8. Click **Electrical Schematic Object** as the current property set.



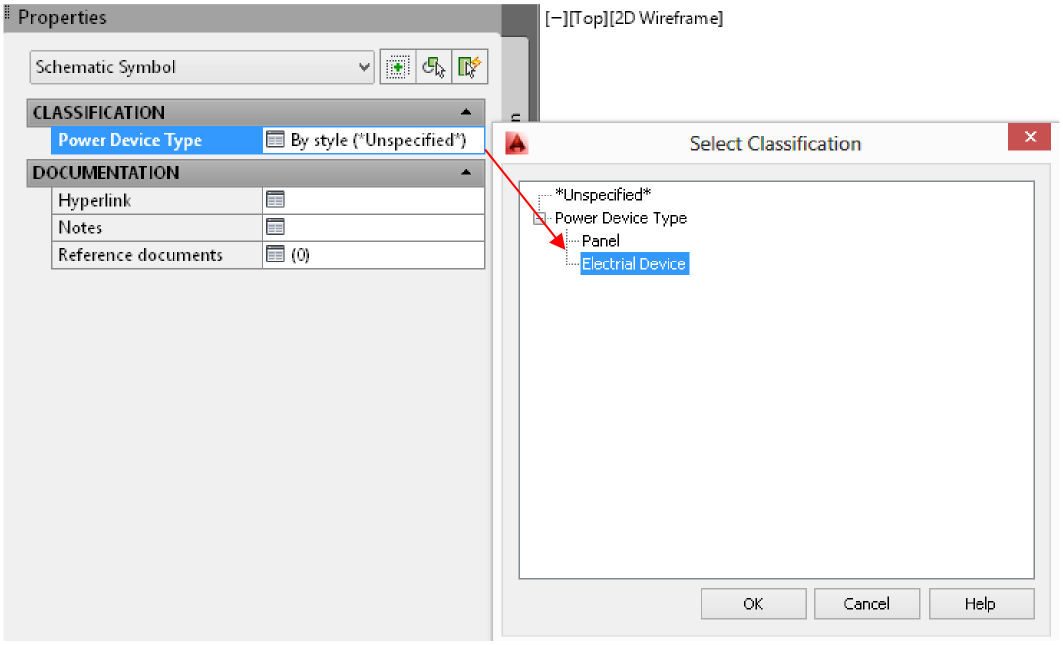
9. On the **Applies** tab, note how this is applied to **schematic symbols** that include the **Electrical Device** classification.



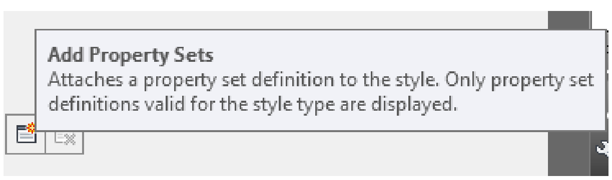
10. Click the **Definitions** tab. Click **Add Manual** to create a new definition, and name it **Circuit Number**, with no spaces in the name. Click OK to add the definition.



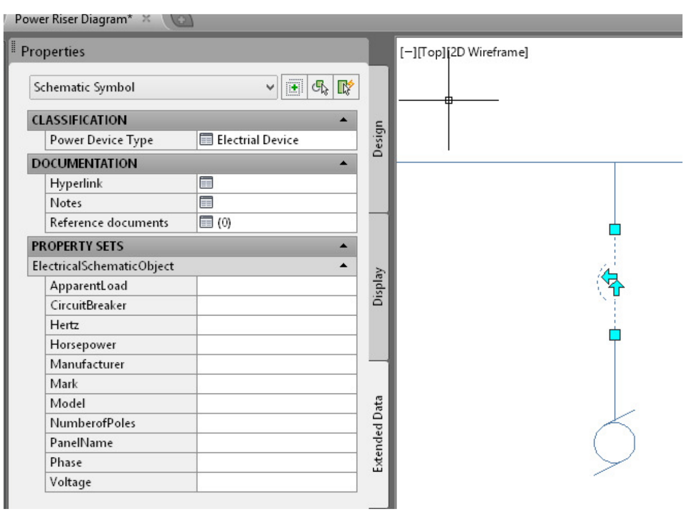
11. Click OK to exit the dialog.
12. Select the circuit breaker. On the **Properties** palette, select the **Extended Data** tab.
13. For **Classification**, change this to use the **Electrical Device**.



14. Select the Circuit breaker again. This time, use the **Add Property Sets** tool on the Extended Data tab.



15. Make sure the **Electrical Schematic Object** is selected, and then select OK. The definition is now available for editing.

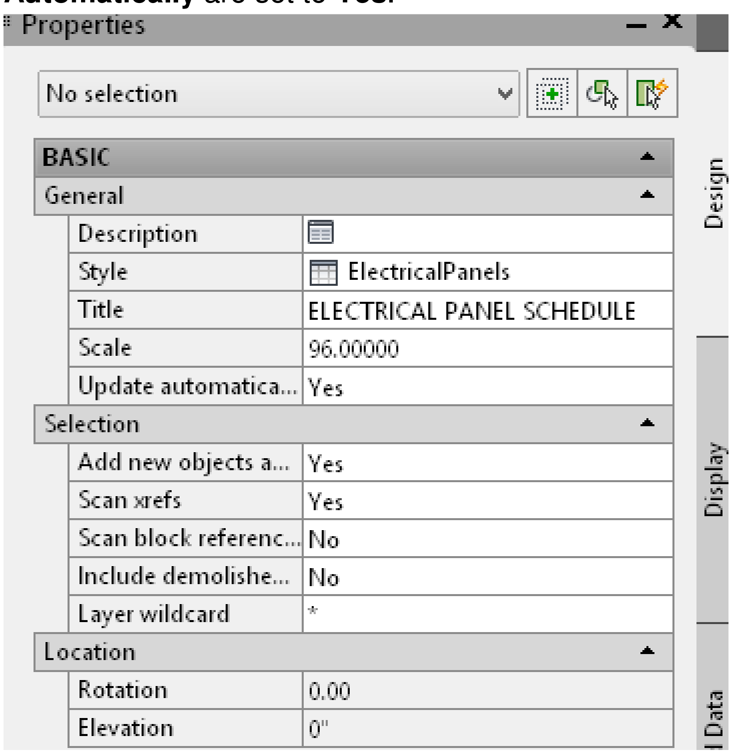


In this case, we added all of the property sets under one classification, but you can create as many of these as needed, to correctly sort data associated with objects. The definition can also be added to a tag, which will leverage the data assigned to this definition to populate it.

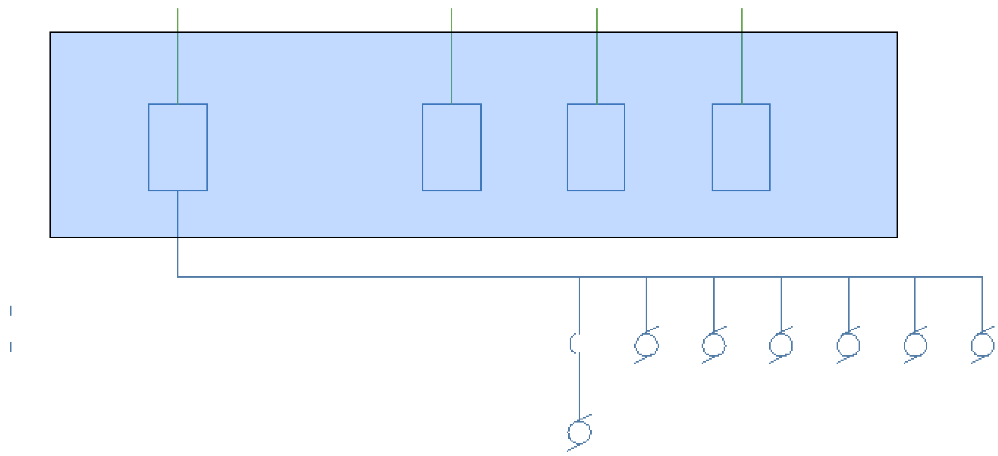
So why go to the trouble to do this, and what does it have to do with Revit?

First, we're using the diagram for more than just a drafting tool. We're using it to associate data with symbols that can be associated with other panels, electrical devices, views and other drawings. The data can be extracted to Excel, where it can be sync'd via links to other spreadsheets, or databases.

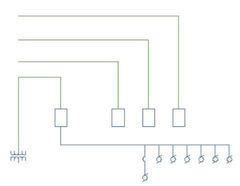
16. From the command line, type **ScheduleAdd**. In the **properties** dialog, set the style to **Electrical Panels**, and make sure **Update Automatically** and **Add New Objects Automatically** are set to **Yes**.



17. In the drawing use a **window** selection to pick the panels. This schedule is defined to only use objects that have the **Electrical Panels** classification assigned to the parts, so don't worry if you pick other devices by accident.



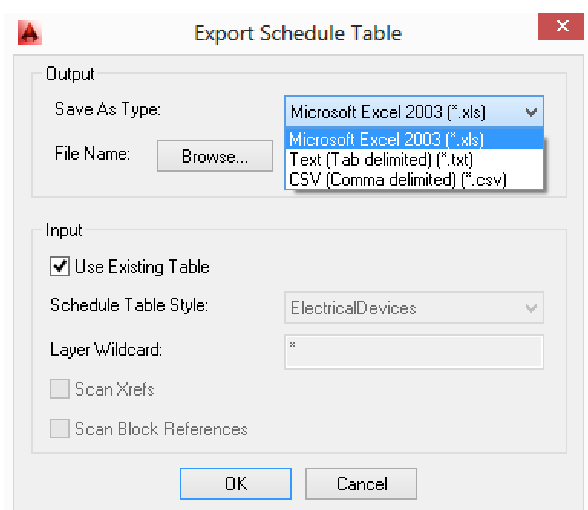
18. Press **ENTER** after picking the parts, and then place the schedule. The schedule will contain any information you can associate with the panel.



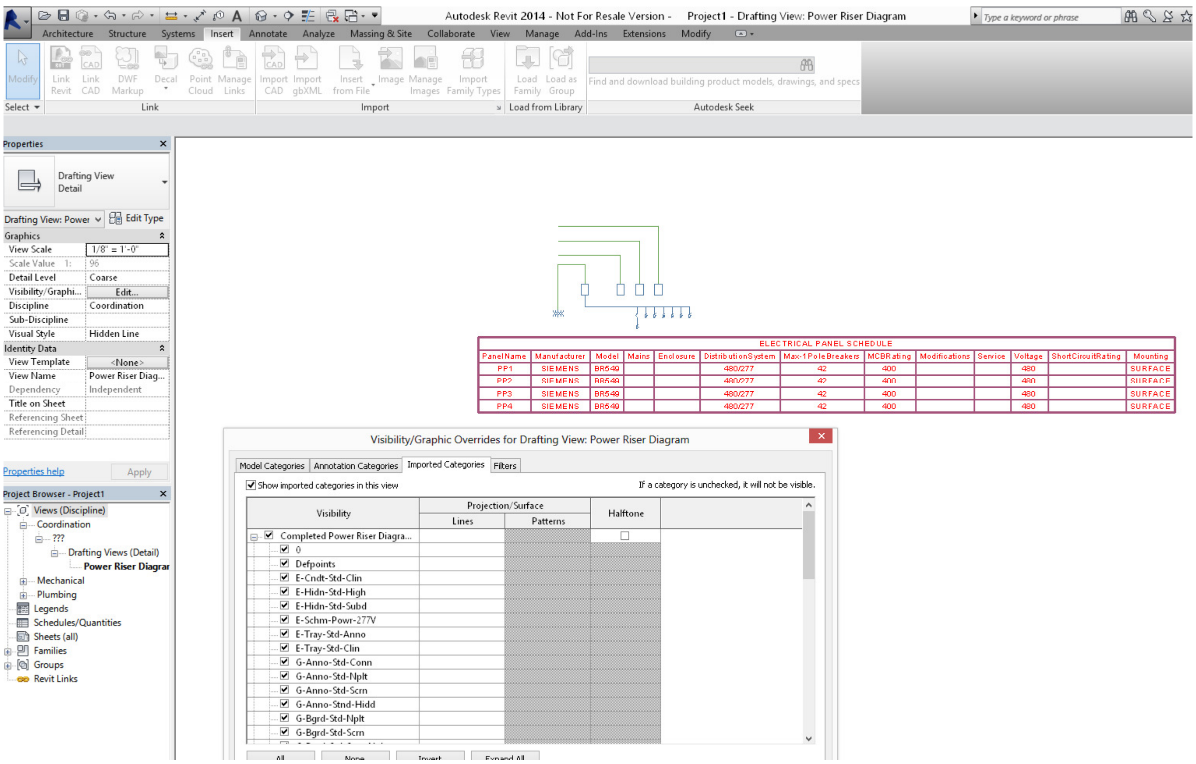
ELECTRICAL PANEL SCHEDULE

PanelName	Manufacturer	Model	Mains	Enclosure	DistributionSystem	Max-1PoleBreakers	MCBRating	Modifications	Service	Voltage	ShortCircuitRating	Mounting
PP1	SIEMENS	BR549			480/277	42	400			480		SURFACE
PP2	SIEMENS	BR549			480/277	42	400			480		SURFACE
PP3	SIEMENS	BR549			480/277	42	400			480		SURFACE
PP4	SIEMENS	BR549			480/277	42	400			480		SURFACE

19. To export the table, simply select it, right click and choose **Export**. You can save to an Excel XLS, CSV or TXT file as needed. As you update the table, simply export it again, and overwrite the data.



You can use these drawings as linked drafting views in a Revit model, and then continue to update them as needed.



And creating the view in AutoCAD MEP using the built-in automation is faster than manually assembling the diagram.

At our firm, we have an application developed that exports and imports data from any object to Excel, which allows to compare or link data between the schematic schedule or the AutoCAD MEP data. While we developed our own utility, there are several available on the market to help you extract data to XLS or CSV format. Once it's out, you can use OLE links and other methods to combine and compare data.

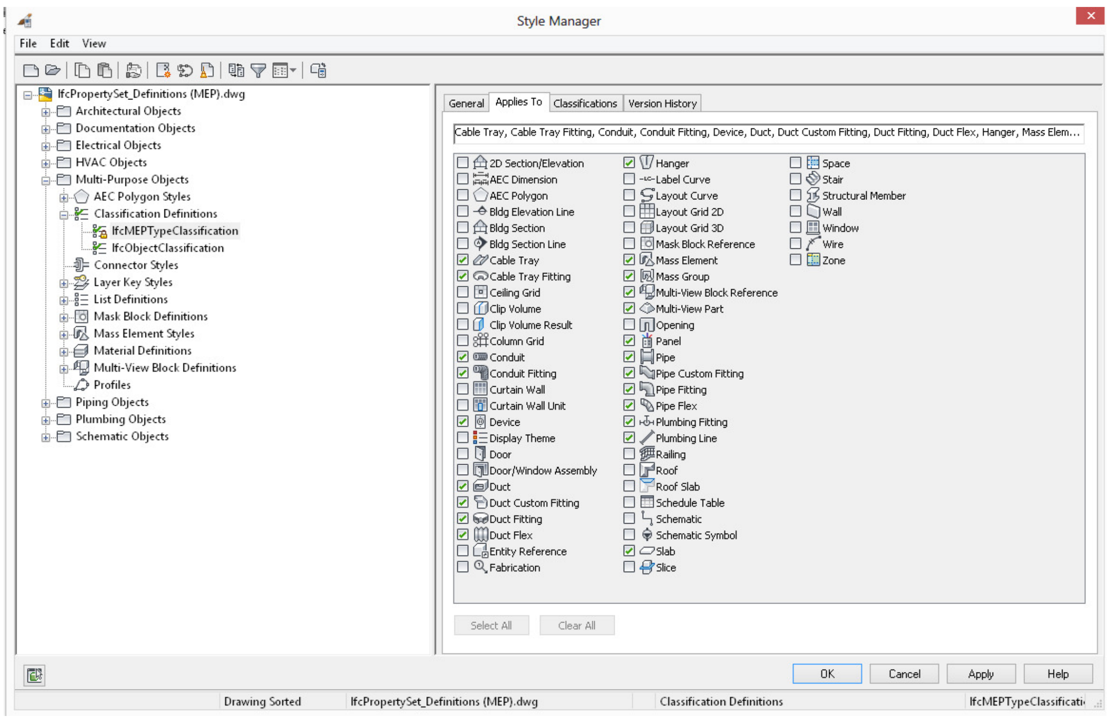
Exercise 3: Using IFC Tools to Export and Import Projects

At some point, you may have to exchange files with other BIM applications such as Revit. In this exercise, we're going to look at both the export and import methods used in the AutoCAD MEP Environment.

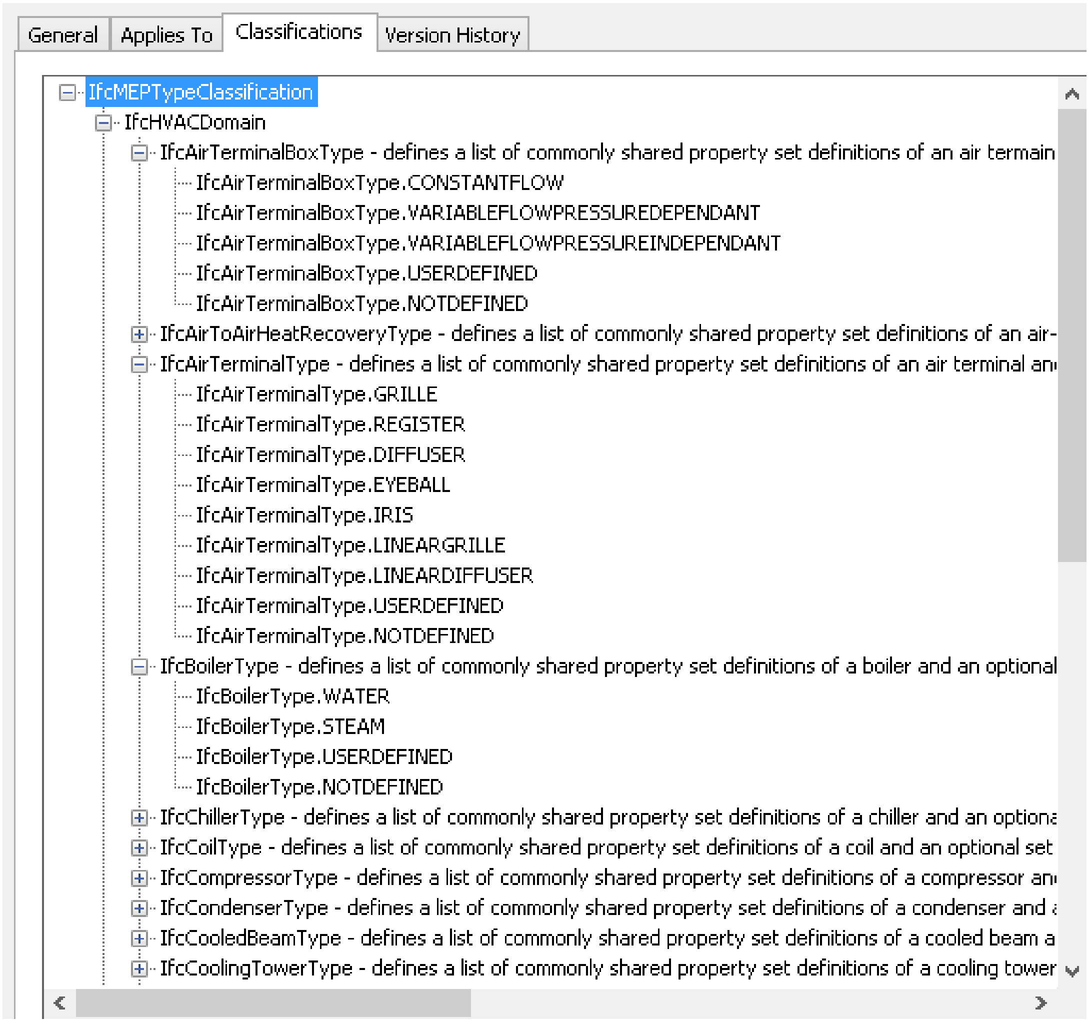
IFC stands for Industry Foundation Class, and it's a file format that is universally shared between CAD platforms. The intent is that an object in a program like AutoCAD MEP can be converted into the same type of object in Revit, or other BIM applications.

Exporting from AutoCAD MEP to Revit

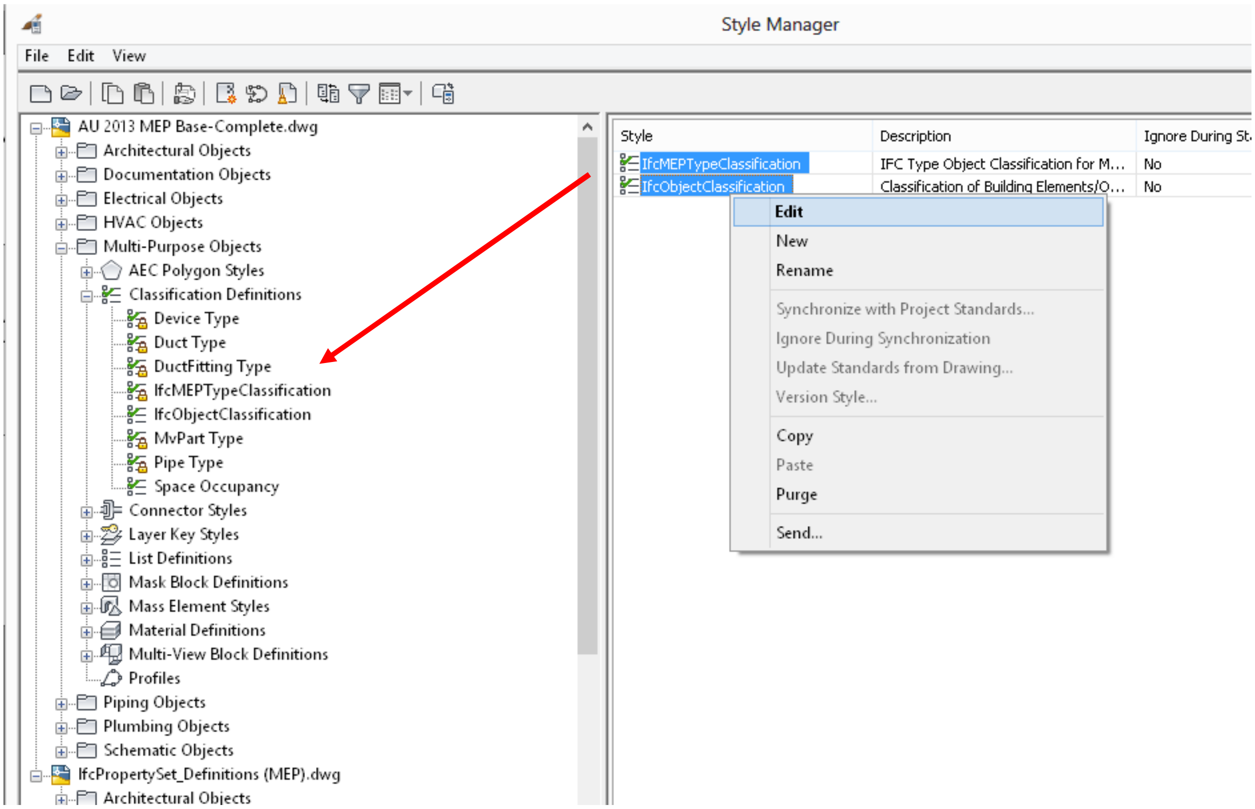
1. Make sure you have the **AU 2013 MEP Base Complete.dwg** open.
2. In order for an object to be exported to IFC, it has to have an object classification assigned. To look at the default styles go to **ProgramData\Autodesk\MEP 2014\enu\Styles** directory and open the **IfcPropertySet_Definitions (MEP).dwg** file.
3. In the style manager, look at the classification definitions under *Multi-purpose objects*. IFC properties can be assigned to these objects:



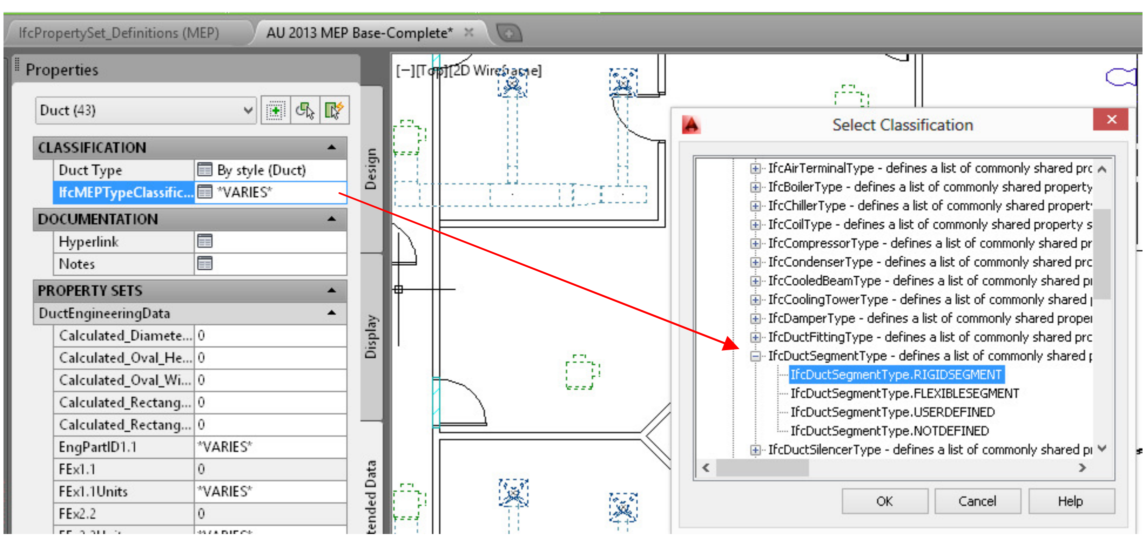
4. Once the items are selected, the **classifications** tab lists the information associated with an MEP object that will be exported:



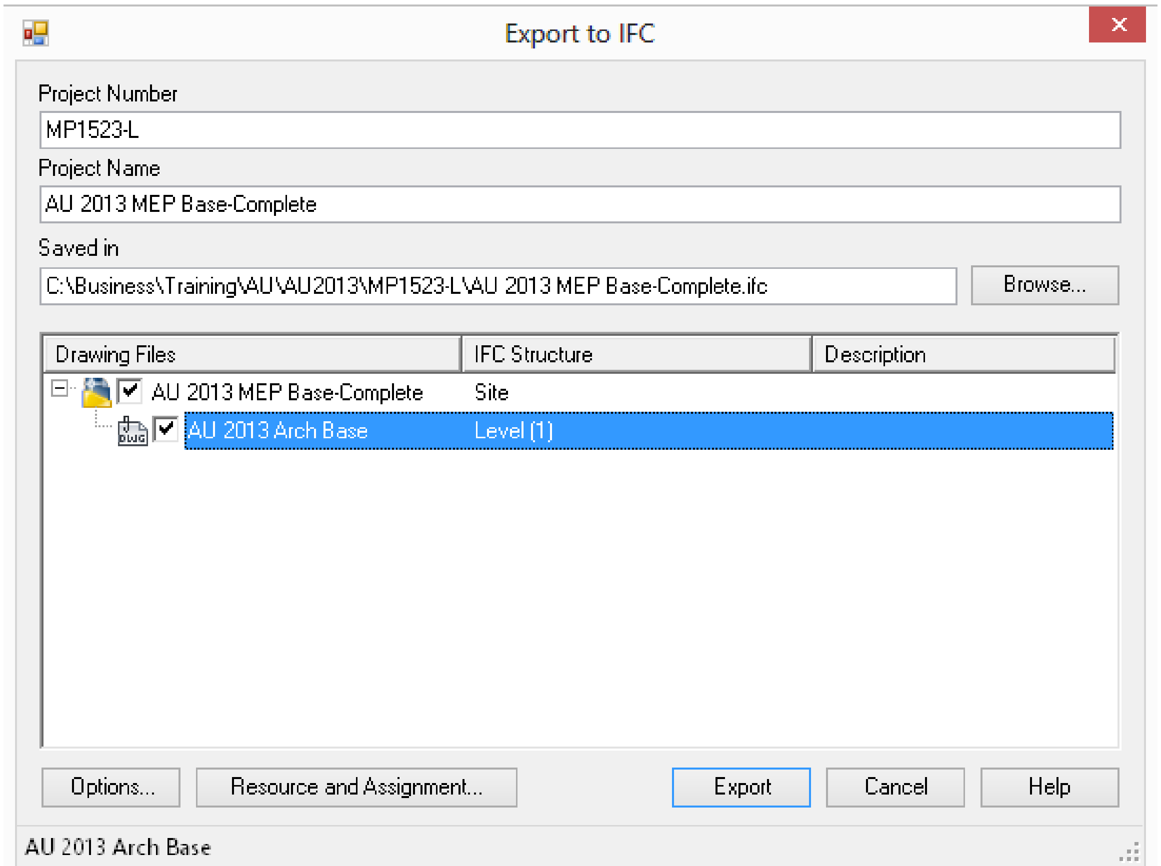
5. To use these in a file, and assign them to MEP objects, you have to copy them into your current drawing. Use copy and paste in the **style manager** to add both classification definitions to the current drawing:



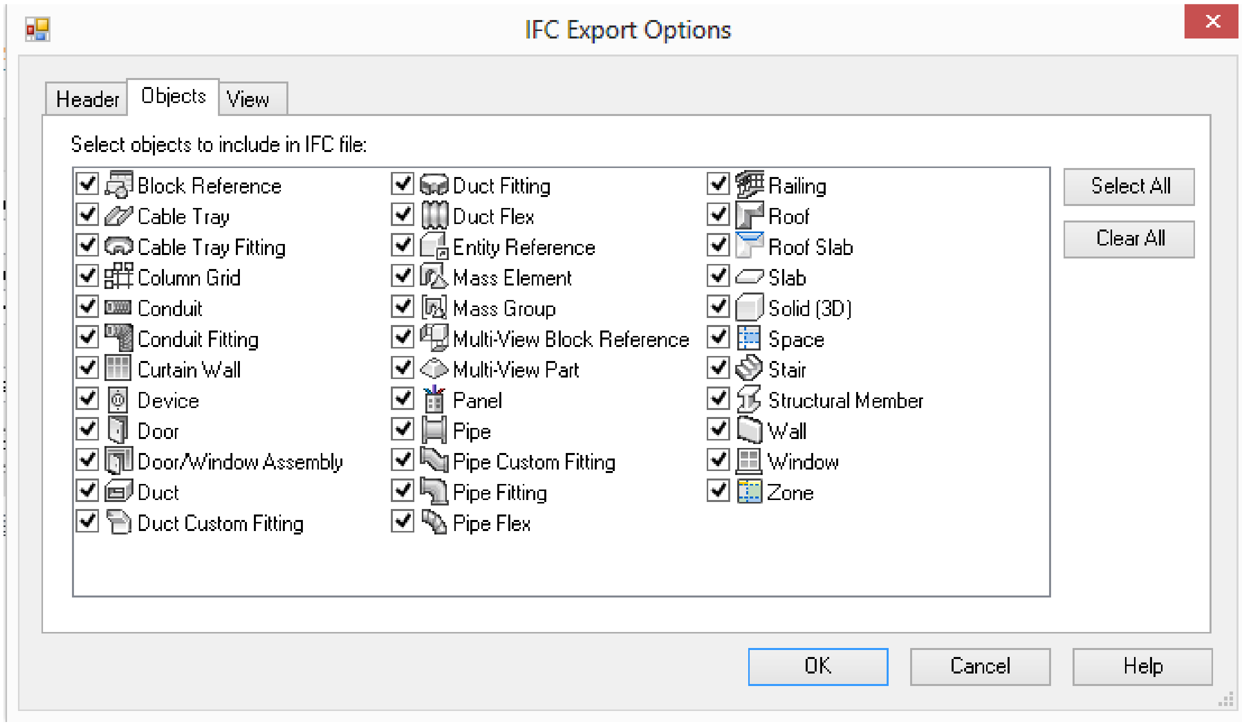
6. Select **OK** to exit the style manager. Now that they're in the drawing, you can edit the properties of objects to assign the classification. I'll grab the ductwork, and then go to the properties palette:



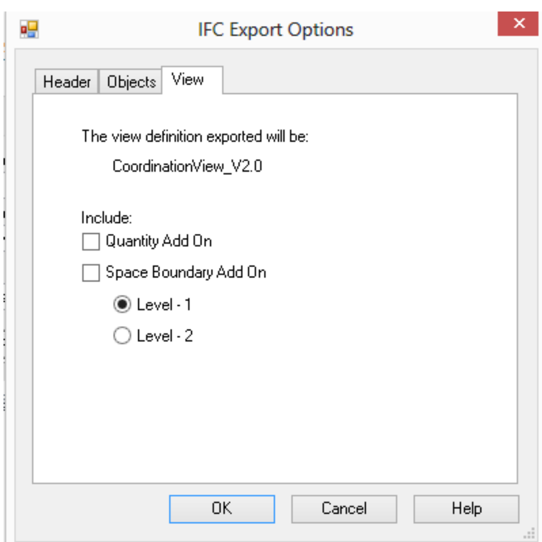
7. Select the **Classification**, and then expand **HVAC** objects until you locate **duct segments**. This tells Revit and other BIM applications what type of object this 3D solid represents. For most other parts, **IFC Type Classifications** are mapped to **MvPart Objects** (such as equipment, panels, and devices) automatically. This classification is added in the Autodesk Catalog Editor by default. You can modify this classification or add more classifications to the content library in the Autodesk Catalog Editor.
8. Once you've added the correct classifications to MEP objects, click **OK** to exit the dialog.
9. Next, we'll review the **IFC export** settings. From the application menu, select the *Export* tool, and then select **IFC**. The options are located on the export dialog:



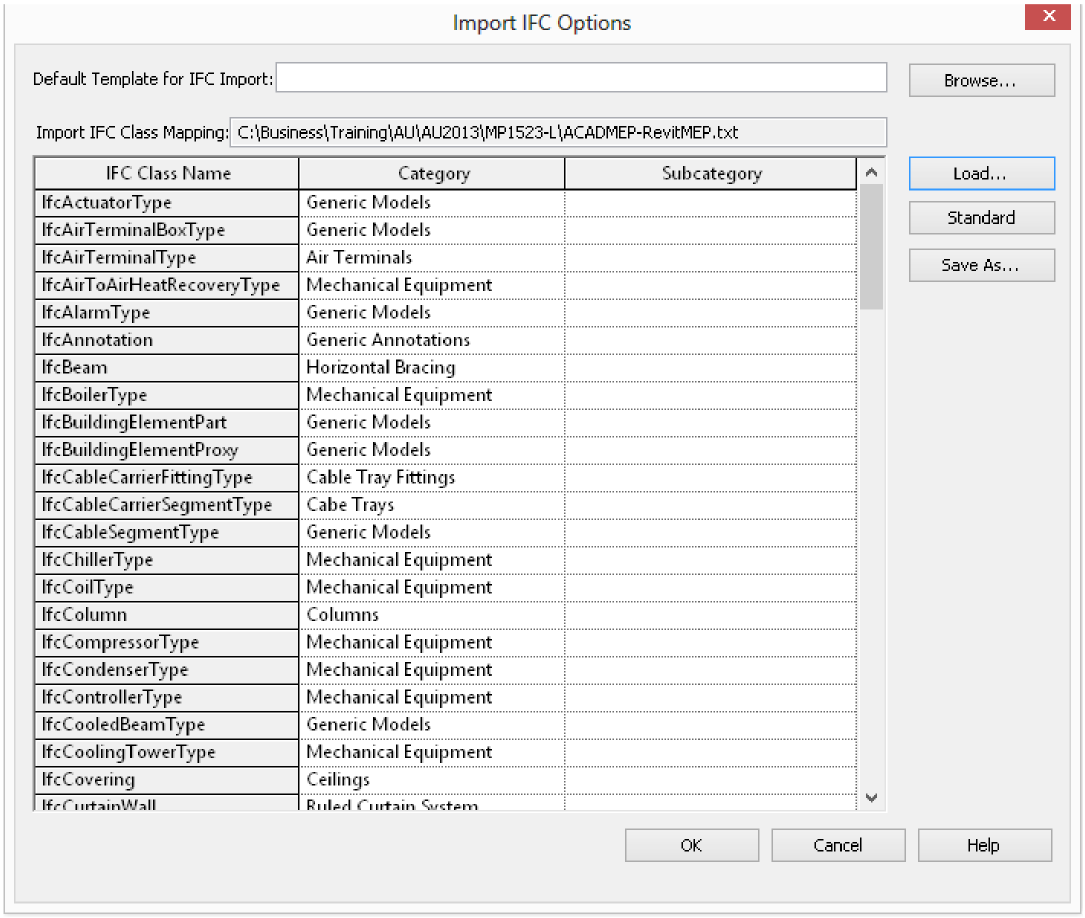
10. If you don't want to include the architectural base, you can deselect that option. Next, select **Options**. The **Objects** tab lists all objects that loaded into a drawing – you can choose to add or remove objects as needed:



11. The view tab shows the name of the view that will be created, when imported in other applications such as Revit:



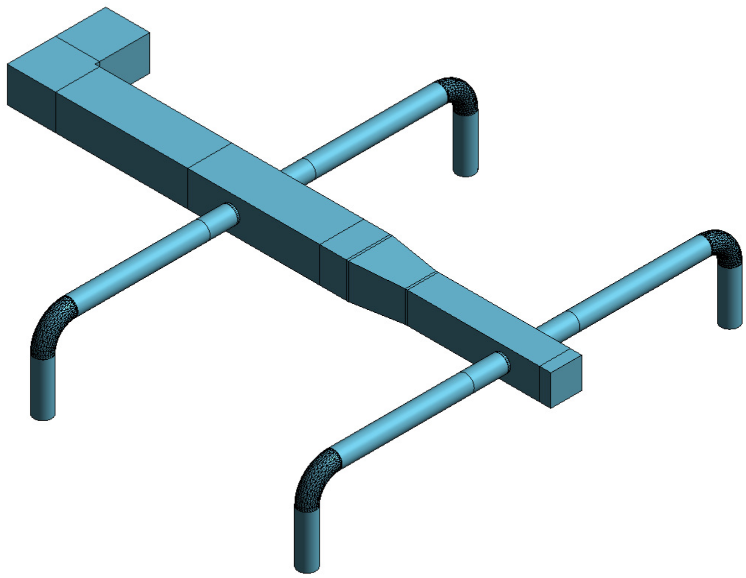
12. After you review the options, click **OK**. Now, you can run the **export**. The IFC file is created in the project folder. To test this, I'm going to open the file in Revit. Before doing this, open the **IFC Import** options on the **Application** menu, under **Open**:



13. Before importing an IFC file, you need to go through and **map** IFC class names to **Categories** and **sub-categories**. This tells the MEP object what is used to control its display in Revit. You can also select the default Revit RTE file to use as a starting point, so make sure you select this before opening the file.

TIP: I've saved a copy of the text file mappings for this class, which should be available online under the course materials.

Once the IFC file is imported, the duct will appear something like this:



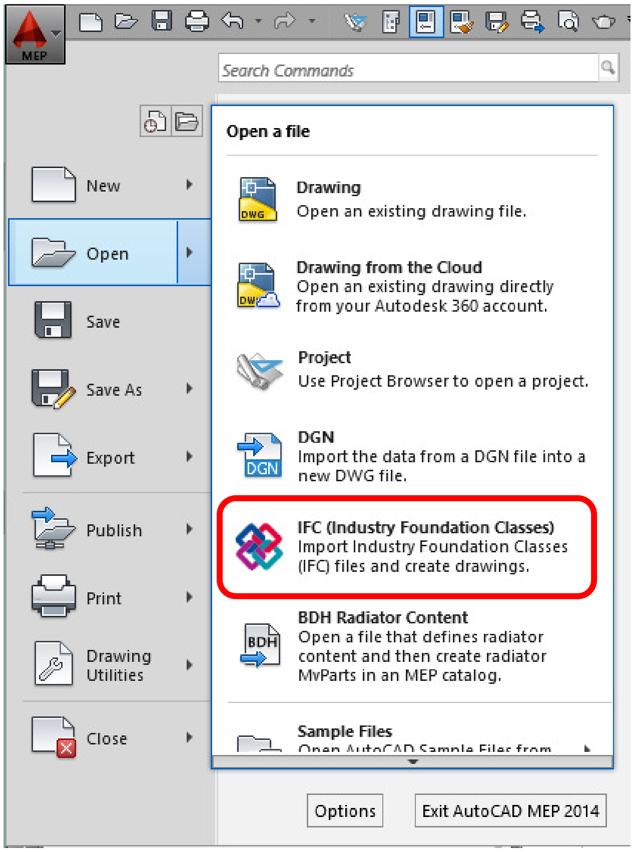
The imported objects take on most of the characteristics of the equivalent objects in Revit. You may need to check IFC mappings in both the AutoCAD MEP file and the Revit file during this process, but this represents the level of detail that can be obtained when moving from AutoCAD MEP to Revit.

Be aware that imported objects may not completely take on the behavior of a normal duct. For example, the duct is treat like a duct with properties assigned, but it does not include the connection, system or sizing behavior. You have to add a connector to attach duct to it.

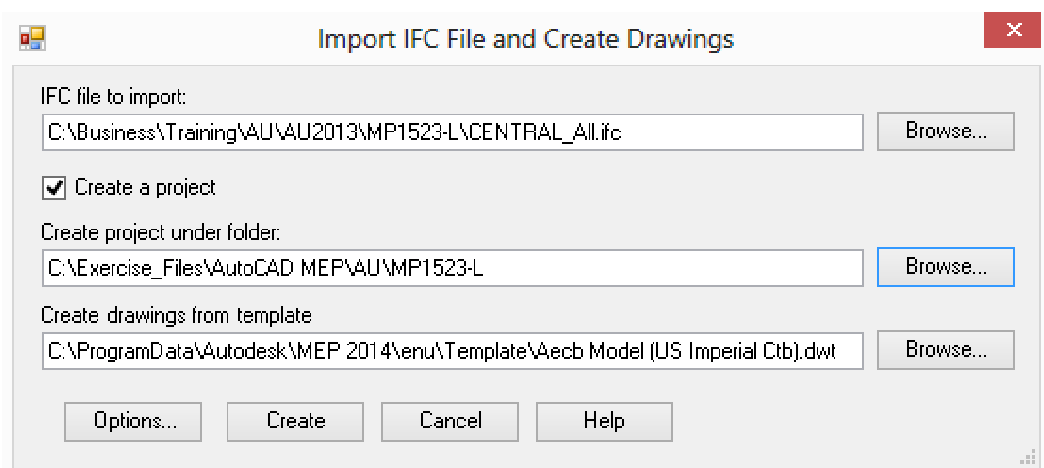
Exporting from Revit to AutoCAD MEP

Next, let's review how to import an IFC file into AutoCAD MEP, and create a project. To save some type, I've already created the IFC file to use in this exercise, so we don't need to work in Revit at this time.

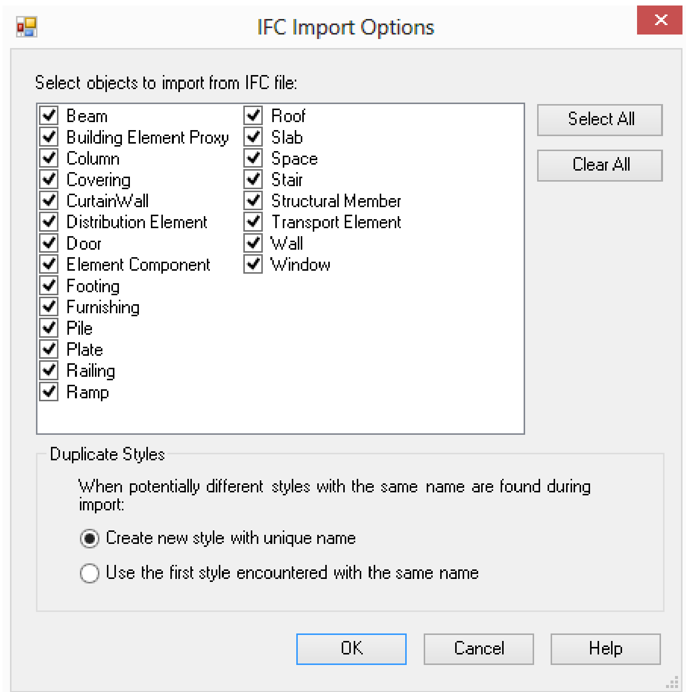
1. Make sure that you close any open drawings, and then create a new drawing using one of the AECB model templates (you need at least one drawing open to open an IFC file). From the **Application Menu**, click **Open**. Select the **IFC** file type.



2. In the **Import** dialog, select the browse button to locate the **CENTRAL_All.IFC** file
3. Select the **option** to create a project.
4. Use the **Browse** button to locate the project in the class folder (**MP1523-L**).
5. Make sure the **AECB Model (US Imperial CTB).dwt** file is the current template file.



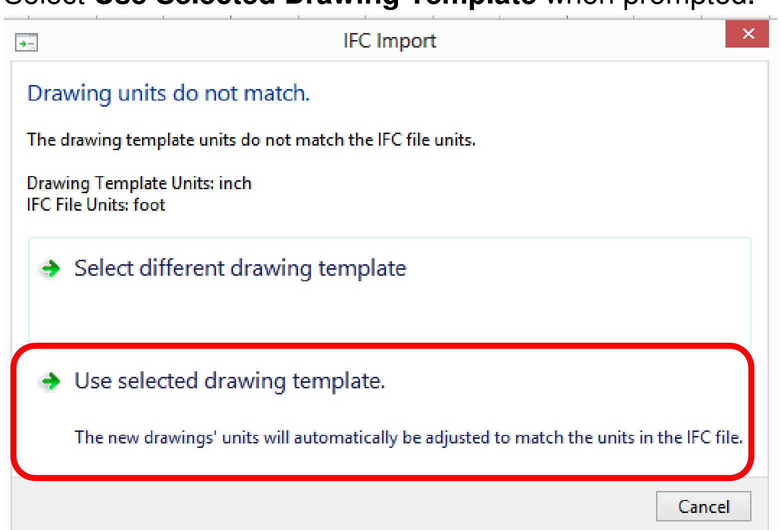
6. Click **Options**. Make sure that all object element types are selected, and use **the Create New Style with unique name** option is selected. Click **OK**.



7. Click **Create** to complete the command

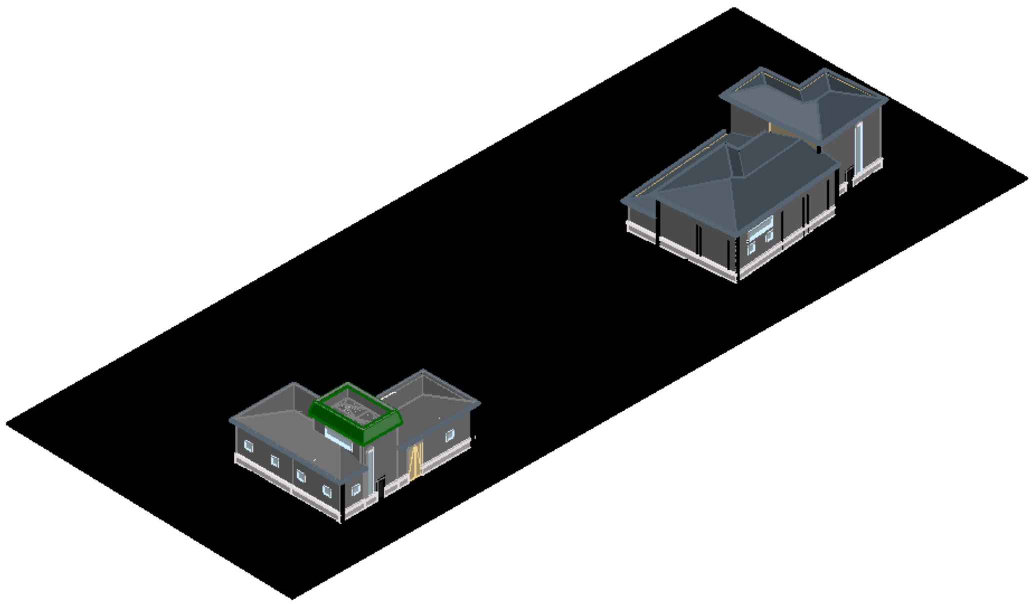
It may take a few minutes to process the entire project. You may also get a warning about mismatched units. This occurs when the Revit units, measure as Feet, and not the same as the selected template, where the default units are in inches.

8. Select **Use Selected Drawing Template** when prompted.

9. 

While this is processing, let's go ahead and review what the outcome will be. AutoCAD MEP will create constructs at every level that is defined in the project. You may wind up with more constructs that you would typically create in an AutoCAD MEP project.

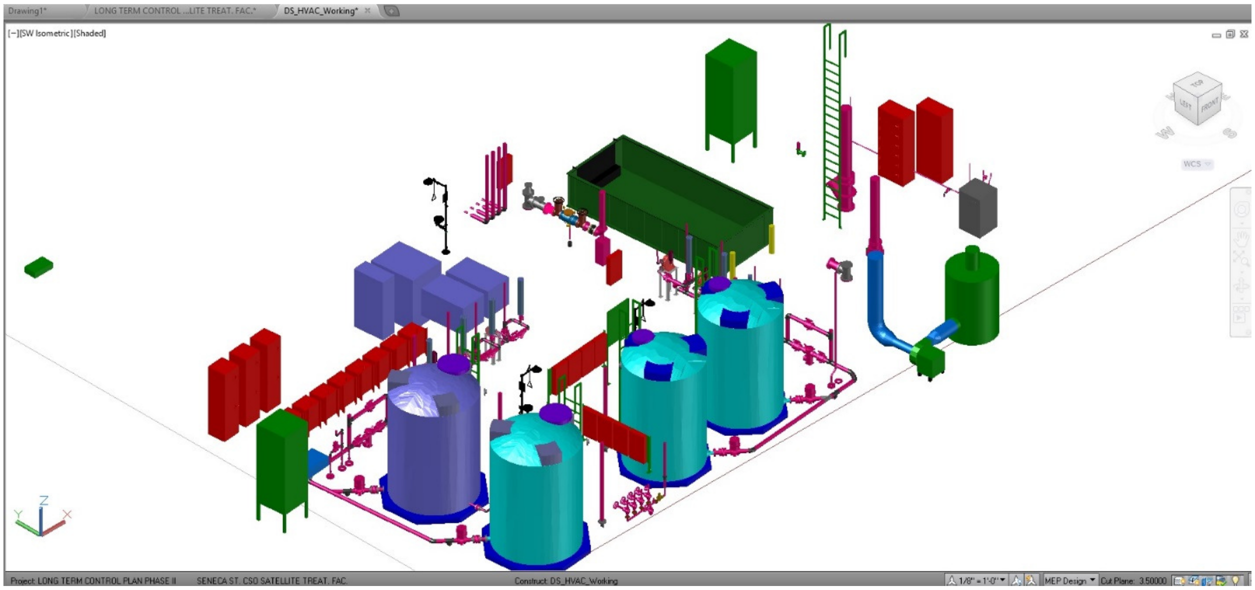
10. When finished, the program will create a project in same location as the IFC file. The Project Name in Revit will be used as the name for the AutoCAD MEP Project. The project will be set current, so open the **Project Navigator**.
11. Open the view drawing, **Long Term Control Plan Phase II** Set the view to a **southwest isometric** view.



You can now select different components by selecting one of the reference files, and opening the file to review how the objects are defined.

In regards to using IFC imports in AutoCAD MEP, there are pros and cons. For basic Architectural imports, you can get a pretty good model representation, with most objects easily recognized as walls, doors and windows. Other objects are converted as multi-view blocks.

The image below is from a full MEP export of the same project. Due to the amount of time it can take to create the file, I'm just adding an image, so you can get a look at how an exported Revit MEP model would appear.



The export to AutoCAD MEP from Revit is even more limited for MEP objects, with multi-views blocks used to define equipment, duct, pipes, fittings and more. The best functional use is for coordination purposes with other designers that are using Revit or other MEP engineering applications that can export MEP models.

In summary, there are a couple of critical items in regards to workflow that you need to keep in mind when IFC use becomes an issue:

- Exporting from AutoCAD MEP to Revit gives you correctly identifiable pipes, duct, equipment and more based on classifications, but no system integration
- Exporting from Revit to AutoCAD MEP gives you limited AutoCAD Architecture capabilities, but only block-based components for MEP objects.
- Best use is for coordination between components when different firms are engaged in a project, and using different software packages.

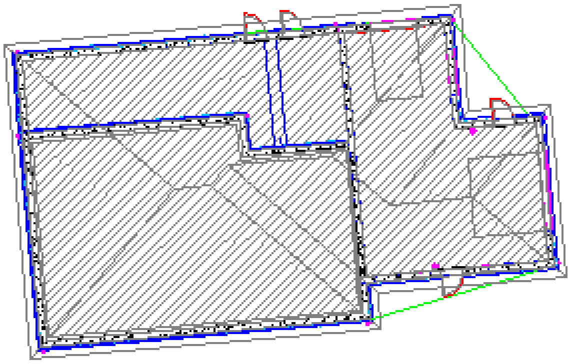
Leveraging AutoCAD MEP Models in External Analysis Applications

One of the features I've liked about AutoCAD MEP for a long time has been its ability to work with external applications, including Green Building Studio, IES Virtual Environment, Vasari and others. One of the reasons why this works so well is due to the behavior of architectural objects such as walls, doors and windows, and space and zone objects for engineering. In this lesson, we'll learn how to make sure our model is optimized for these applications, and then load them up on BIM 360 to use with the Autodesk online solutions.

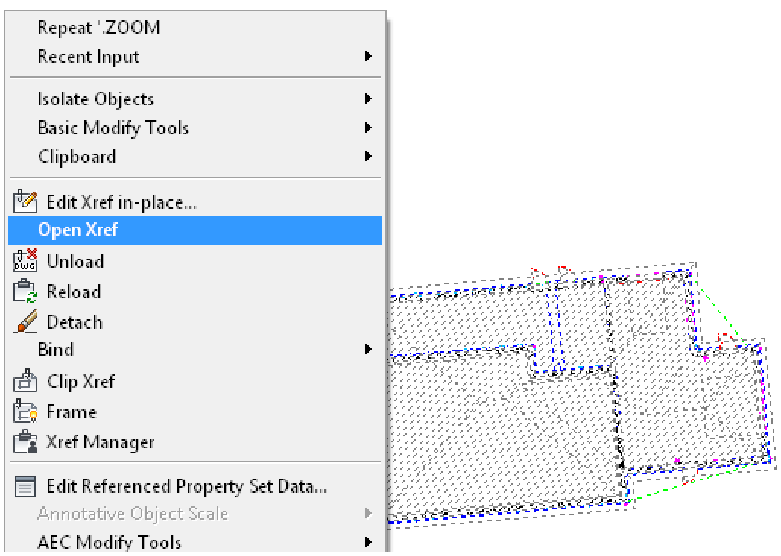
Exercise 4 – Reviewing and Uploading an AutoCAD MEP Model for Analysis

In this exercise, we're going to start with the process model, and add spaces and zones. Once these are defined, we'll review the settings for both objects.

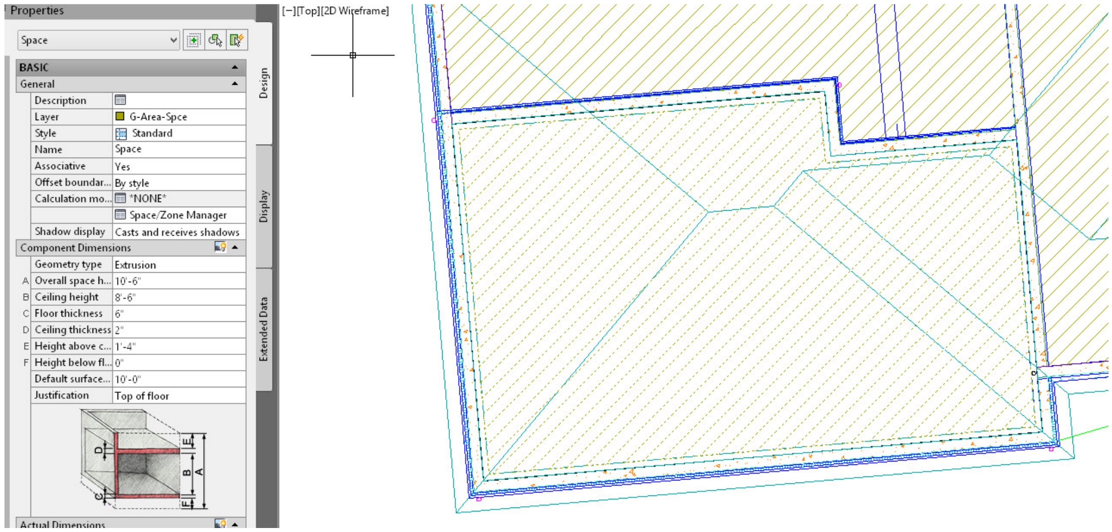
1. From the **Gannett Fleming WTP Example** project, open the **Process Model** construct.



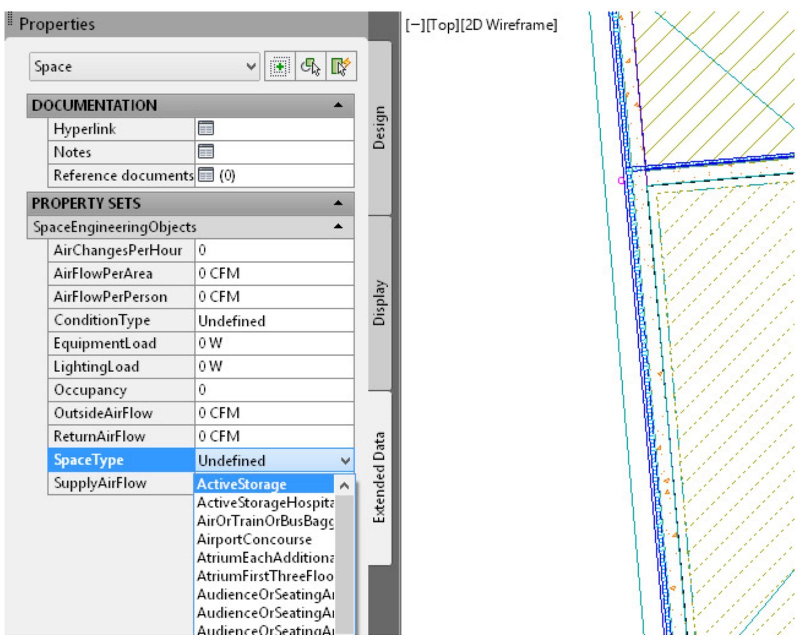
2. Note that the architectural model is loaded as a reference file. Even if the spaces exist in the xref, you can still edit properties of the space, and use them to define HVAC Zones. Let's peek in the xref to see how the spaces are defined. Select it, and then right-click. Select Open Xref. Select the Chemical Treatment Building if prompted.



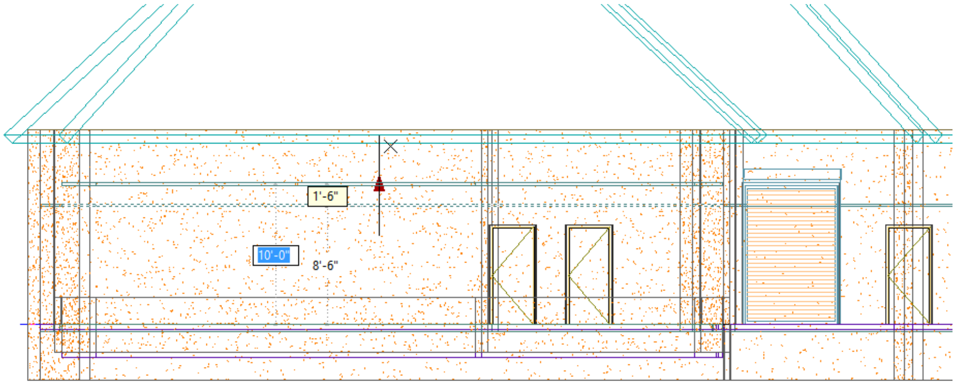
3. Select the space in the chemical storage room, and then open the **Properties** palette. The **Design** tab displays the physical dimensions of the space, including the height, ceiling height, floor thickness and more.



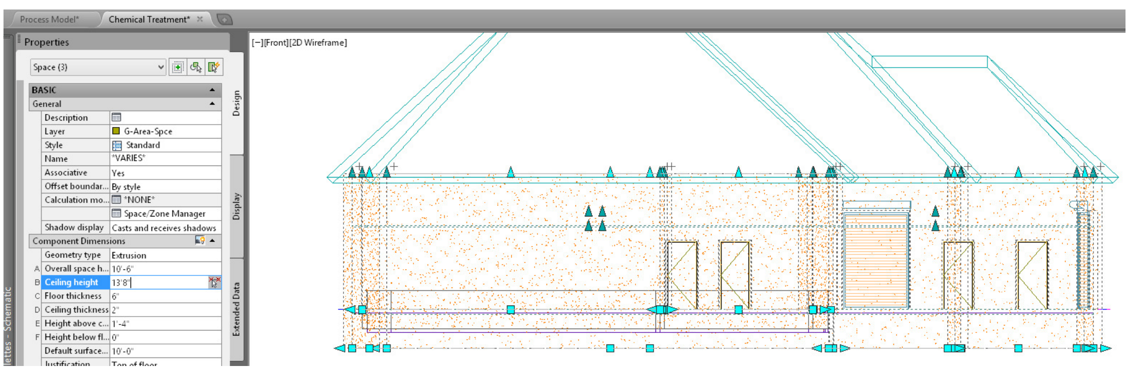
4. Next, set the **Extended Data Tab** current. From here, **Engineering** object property set definitions can be added and edited to include information such as the space type, conditioning and occupancy. Select **SpaceType**, and select **Active Storage**. While this parameter does not include any data, you could use it to tell the analysis application what template to use when performing a calculation for heating and cooling.



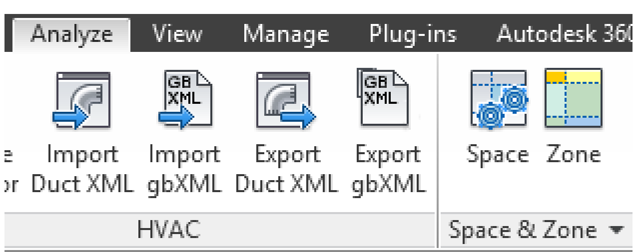
5. Use the **View Cube** to change the point of view to the **South Elevation**. If you already picked the space, it's still highlighted. Note how the space does not go all the way to the ceiling. Use the **grips** to drag the space up above the wall height.



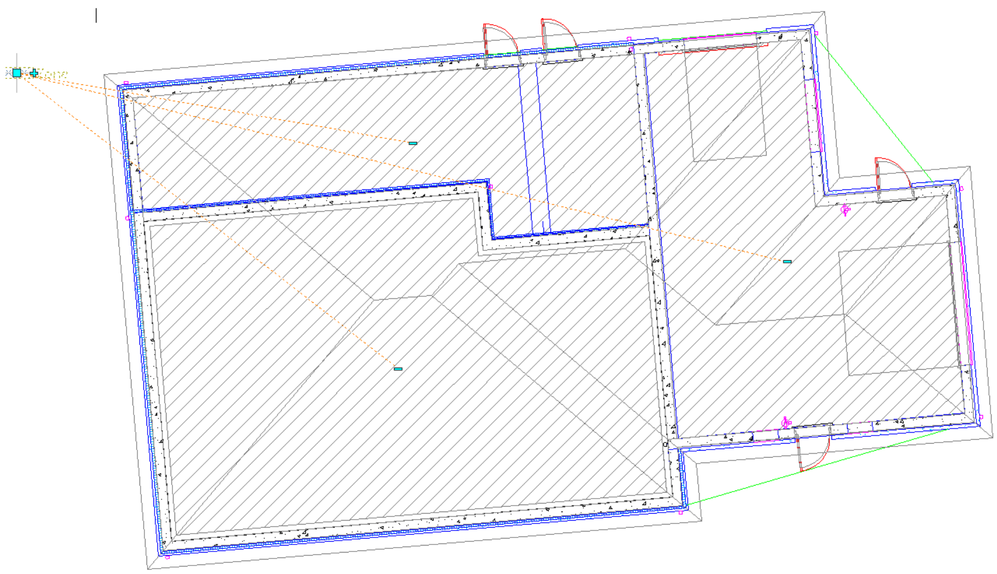
6. While in the view, and with the space selected, right-click. Select the **Select Similar** tool to add the rest of the spaces. Set the **Ceiling Height** to **13' 8**" for all examples.



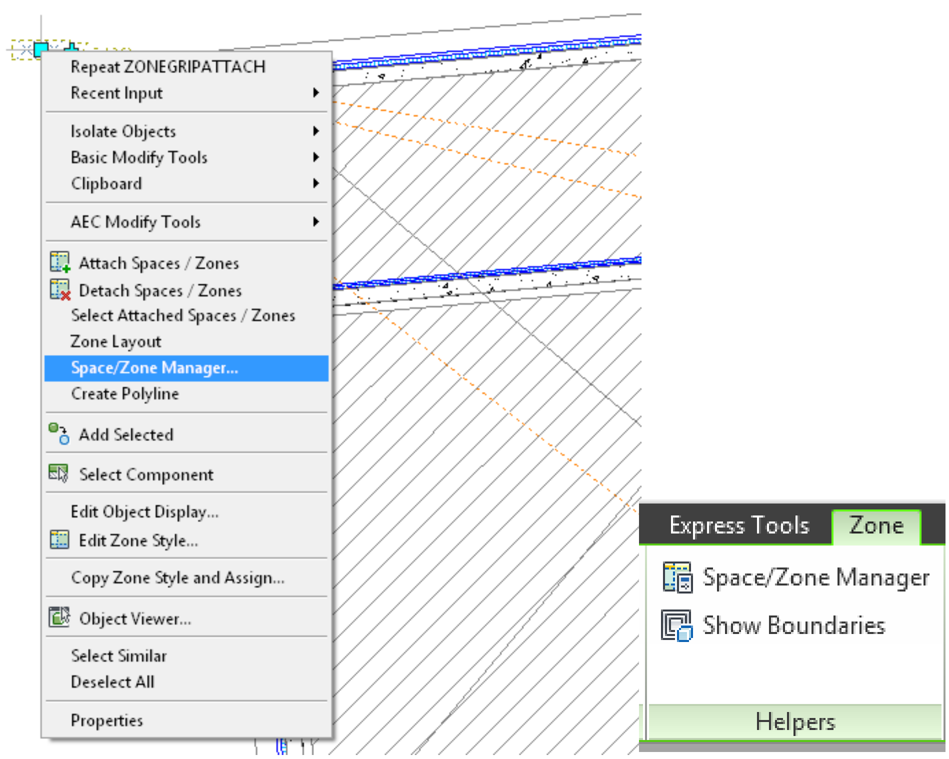
7. Save the drawing, and then close it. You'll be returned to the Process Model, and update the reference file.
8. Now let's add some HVAC data. Make sure the HVAC workspace is the current workspace.
9. From the **Analyze** tab, select the **Zone** tool. Place a zone object next to the building.



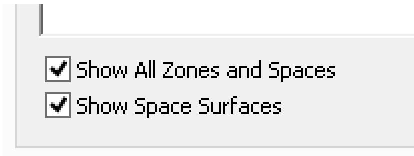
10. Once the zone is placed, pick it. Use the **plus sign grip** to select the spaces in the architectural model – yes, you can pick spaces in referenced files – something Revit can't do.



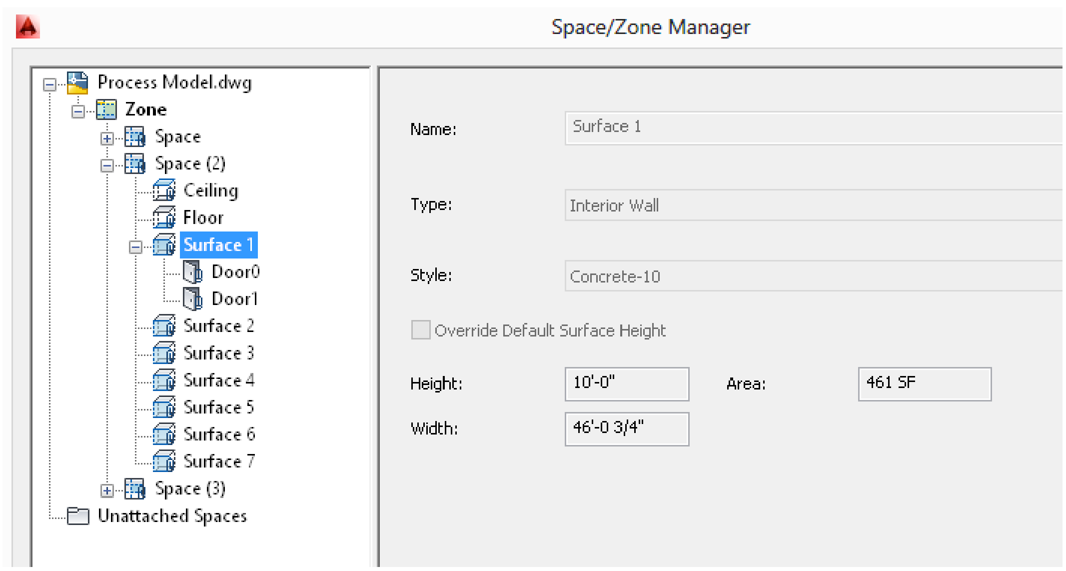
11. After selecting all of the spaces, press **enter** to complete the command.
12. While the zone is still selected, right click. Select the **Space/Zone Manager** tool. You can also select this from the ribbon, **Zone** tab.



13. When the dialog opens, select both options at the bottom of the dialog for Show All Zones and Spaces, and Show Space Surfaces.



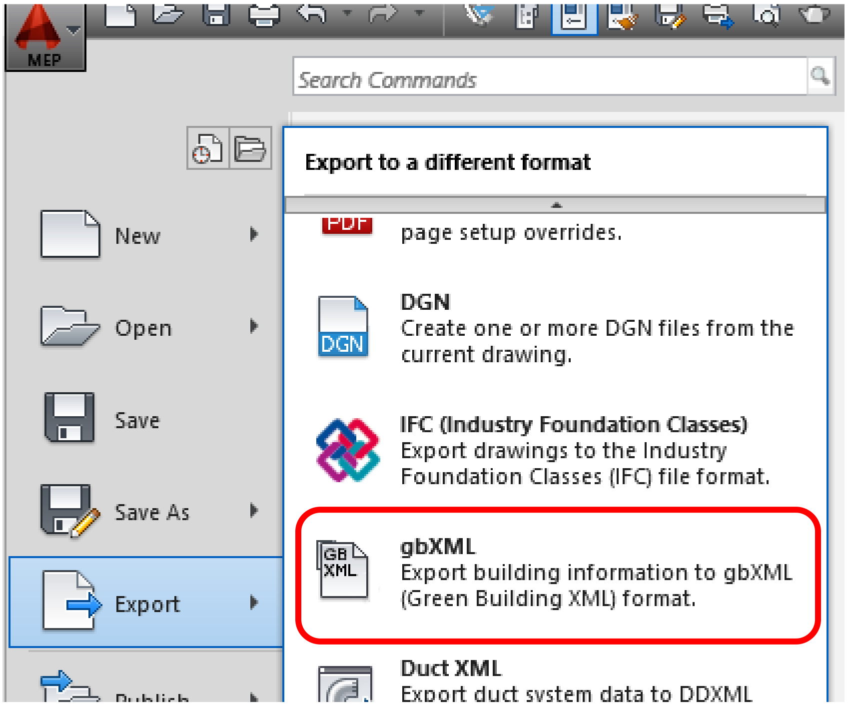
14. Expand the **Zone**. Under one of the spaces, select one of the wall surfaces. AutoCAD MEP will recognize the **style** used to define the wall. The openings in the wall are also indicated, along with their size. This occurs because the spaces are set to be associative when placed. If you disable this feature, you can add or remove openings, or change the style associated with the surface as needed.



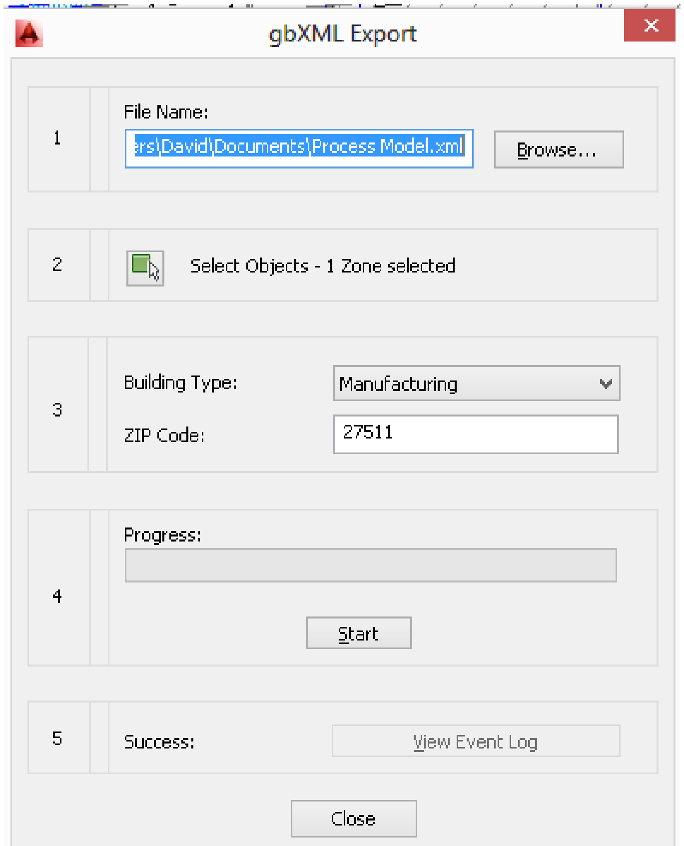
Having the associative capability means that as the architect changes their model, the space is automatically updated. Initially, it's rare to get detailed architectural object information at the start of a project. Having a generic object works, since it gives us the geometry to export to the analysis application. Many of these applications include templates (including Trace and IES VE Pro), that allow you to apply constructions based on assumptions. The model saves the time of having to recreate the surfaces in the analysis application.

One important note – most external applications require zones to be defined, and associate spaces place in occupied areas, prior to using the model for a gbXML import. But they don't require the architectural objects. You can place spaces without the arch model, and use them to create an analytical model as needed. It's just a bit more work later…

15. Save the file. From the Application menu, click **Export**. Select the **gbXML** option.



16. From the dialog, use the **Browse** button to save the gbXML to the exercise folder.
17. Next, if the **zone** is not already selected, use the icon to pick it. You can select as many zones as there are placed in the model.
18. For **Building Type**, select **Manufacturing**, For the **Zip Code**, type in **27511**.



19. Click **Start**. If the application returns an error, review the list. While you can still create the gbXML file, you'll need to make these adjustments once the model is opened in the analysis tool. Click Close.

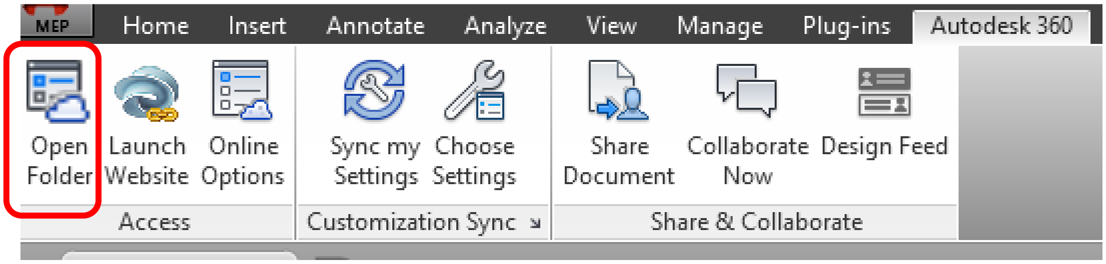
The file is now ready to use for analysis.

Since using **Autodesk 360** in a lab may be a little time consuming, the next part will be "demonstration only", so sit back and relax…

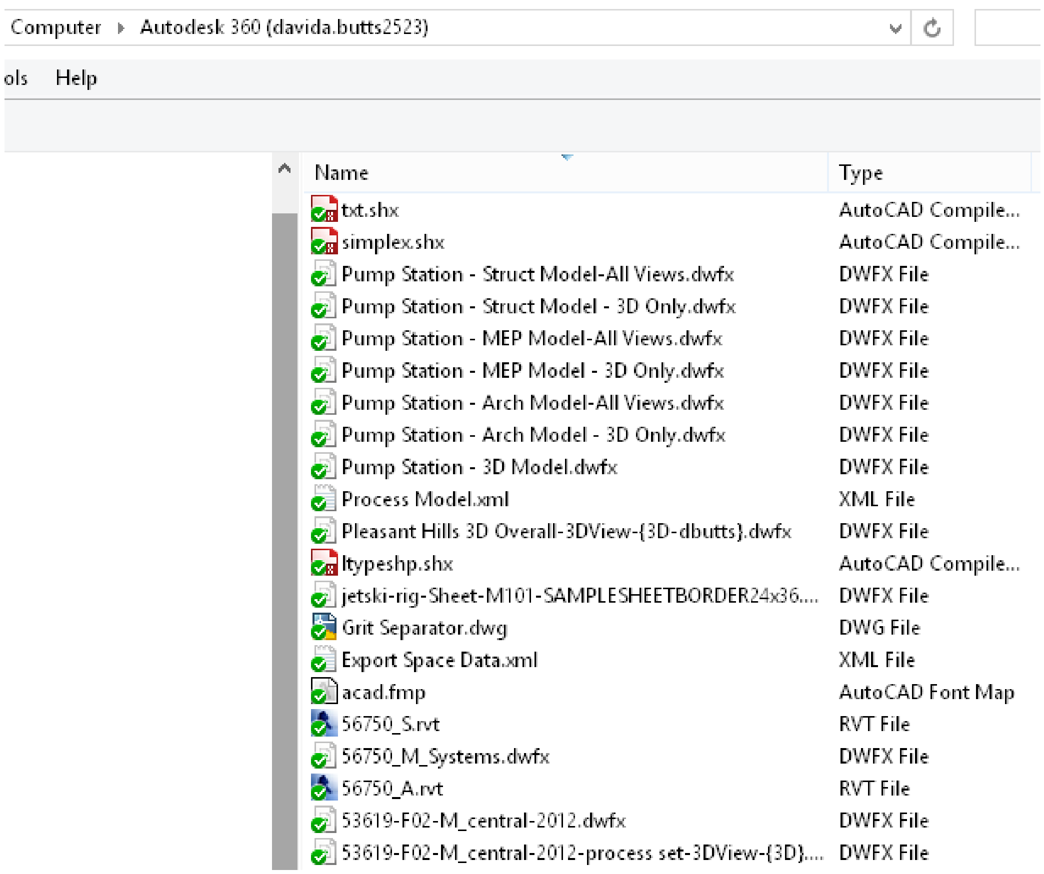
Uploading Files to Autodesk 360

In order to use Autodesk 360 tools such as **Green Building Studio** for analysis, you have to have an Autodesk product such as AutoCAD MEP covered by subscription. While anyone can access Autodesk 360 to store and share files, analysis tools are only included with a subscription.

Once you are logged in, select the **Autodesk 360** tab on the ribbon. Click **Open folder.**

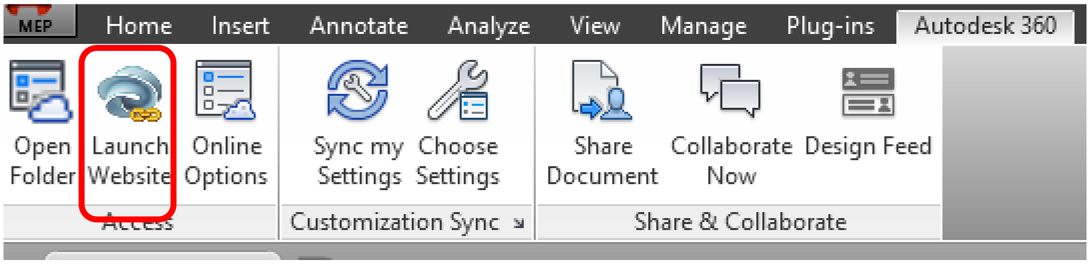


When AutoCAD MEP is installed with the Autodesk 360 option, a **holding folder** is created on your hard drive. If you copy files to this folder, they are automatically uploaded to the **Autodesk 360** cloud.

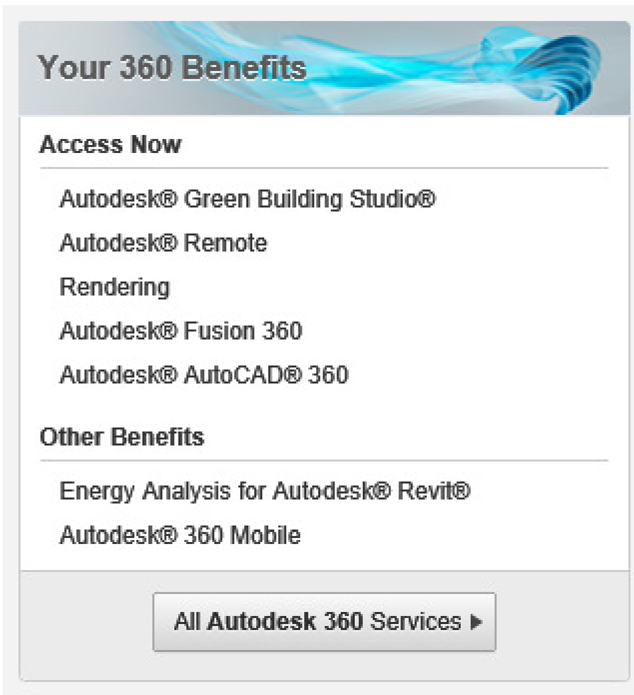


So all I have to do is copy and paste my exported XML file to this location.

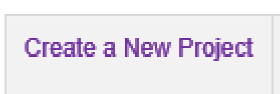
Next, I'll return to AutoCAD MEP, and select the **Launch Website** – make sure you're signed in first. (Note: in some cases, you may have to restart AutoCAD MEP to launch the website after copying files to the holding folder).



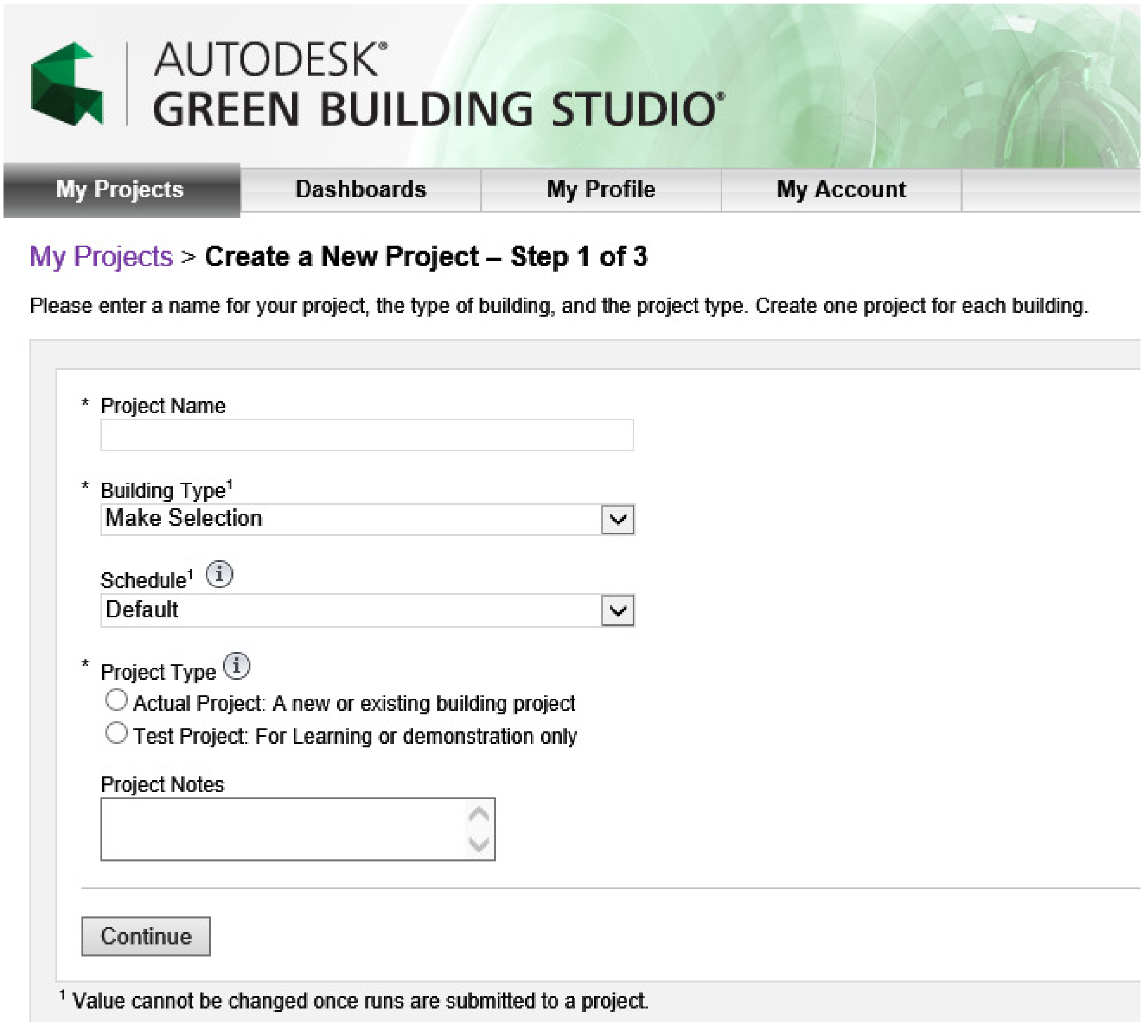
Once the website is open, the tools available with show up under **Your 360 Benefits**.



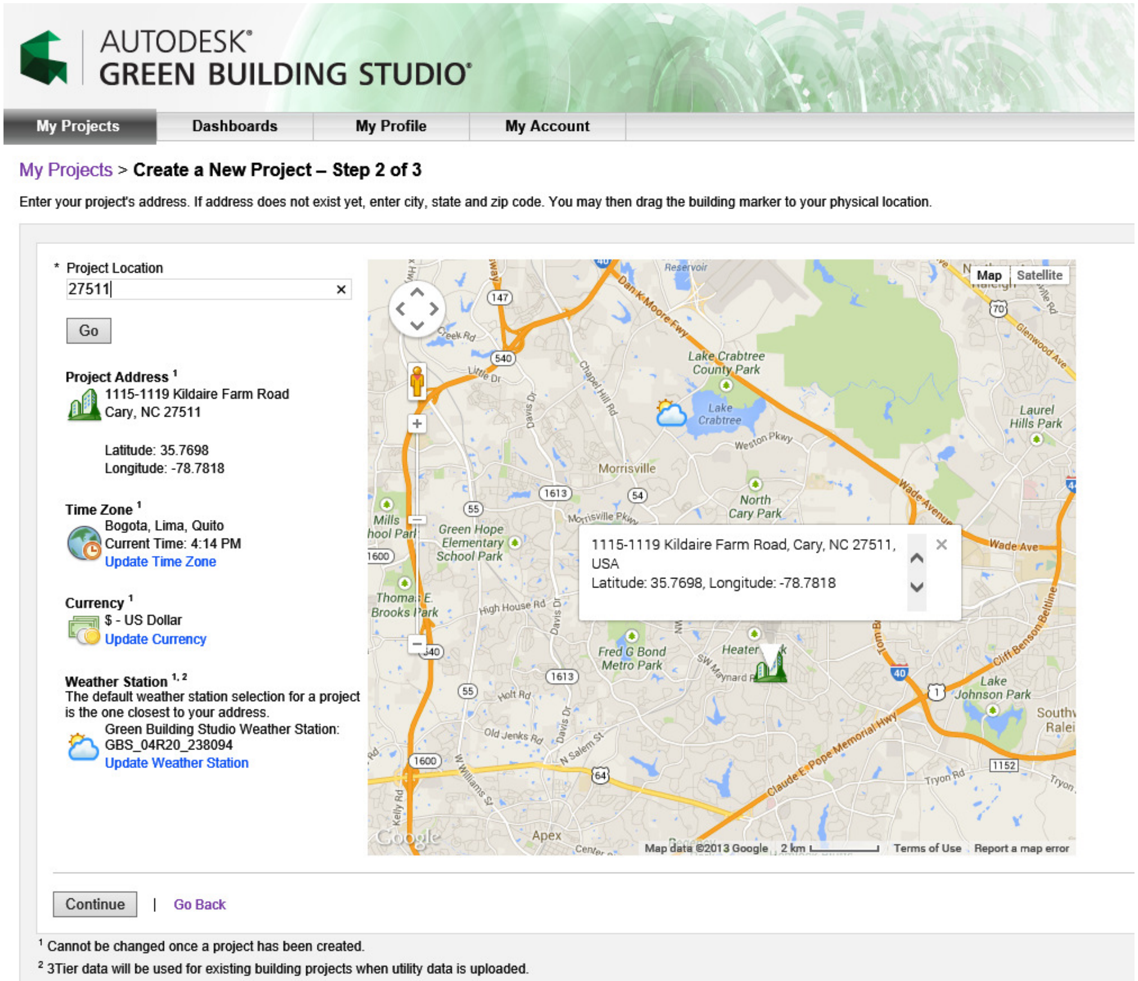
1. Click **Autodesk Green Building Studio**. From the webpage, select the **Create New Project** tool.



2. Name the project as needed. Set the **building type** and **schedule** for occupancy. If you are using a run for testing purposes, select the **Test Project** option. Otherwise, select **Actual Project**. Select **Continue**.

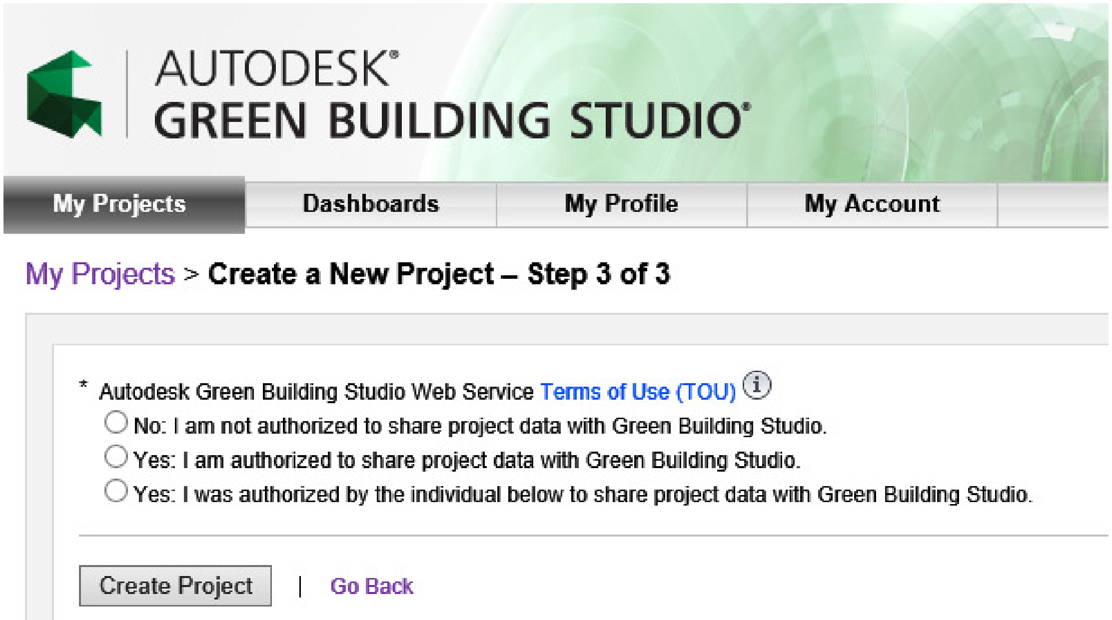


3. On the next screen, select the **location** for the project. You can enter an address, or just select a point on the map.

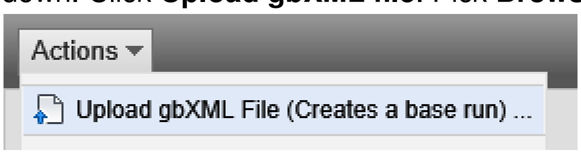


4. Once the address is entered, check and correct the **time zone** as needed. Set the currency to **US dollars**, or select a different currency. Click **Continue.**

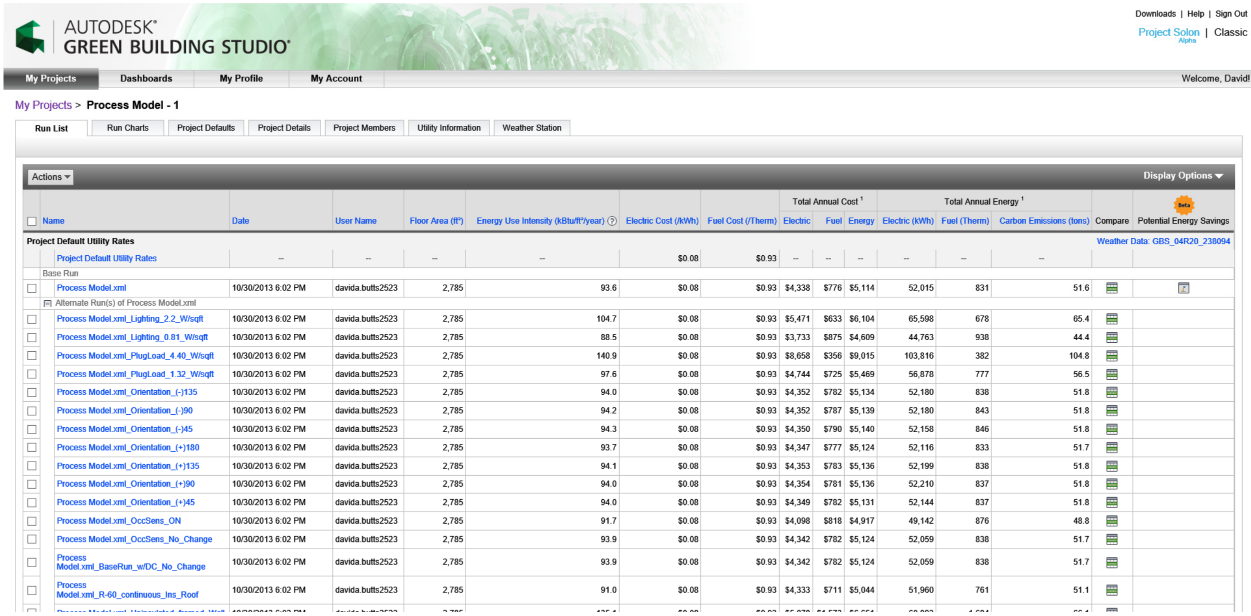
5. On the **preferences** page, you can control data access, contact preferences, and approve the **terms of use**. Select the options you want and click **Create Project** to finish.



6. Once the project is defined, the **Run List Page** appears. You are prompted to set the project defaults and utility information. Once these are reviewing, select the **Action**s pull down. Click **Upload gbXML file**. Pick **Browse**.



7. If you want to use the file on the 360 account, a shortcut to your Autodesk 360 account will appear. Click it. You can now select the gbXML and use it to produce a run.



While we don't spend a lot of time going through Green Building Studio, it's important to understand the steps needed to get to this point. Make sure your AutoCAD MEP has the right architectural objects, spaces and zones needed to get a quick understanding and assist with the analysis of the building.

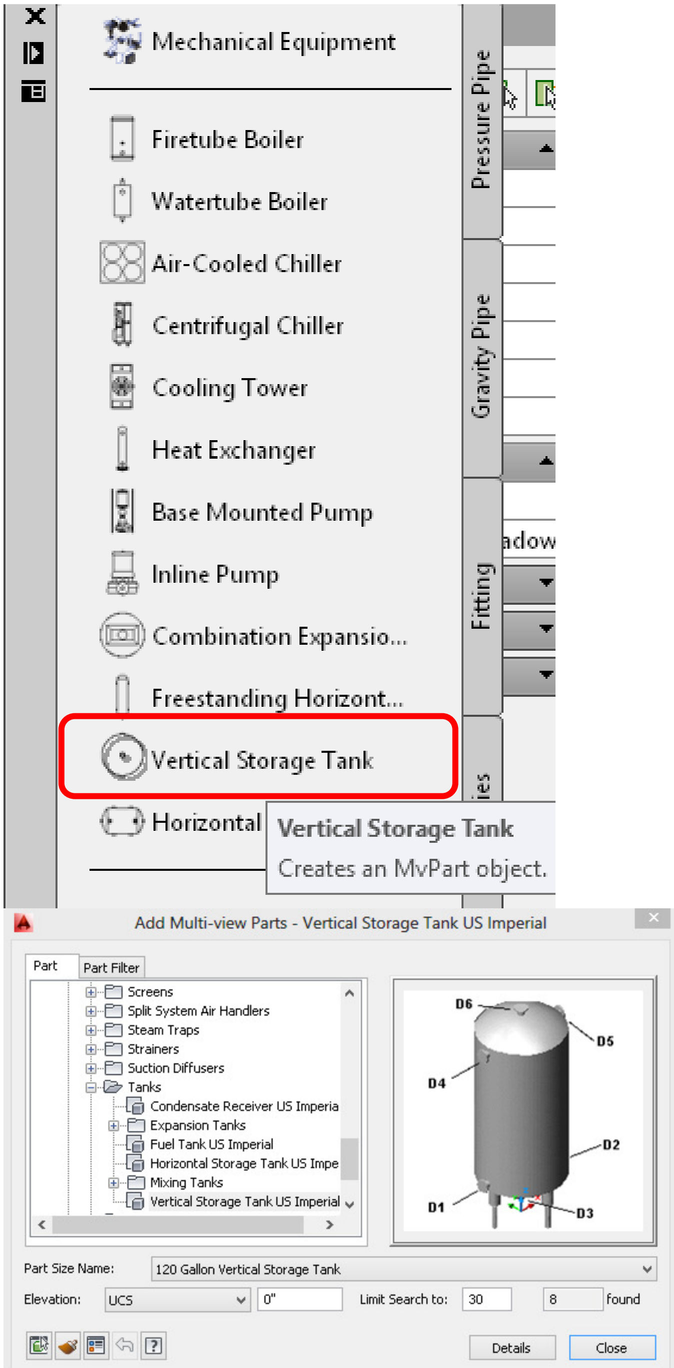
Tips for Customizing Content

Now that we've spent some serious time off the range, let's wrap this up by reviewing some content tips. There are a few things that you really need to know how to do, to get faster in the program. In this lesson, we'll review a new feature for editing existing content, and then we'll look at a feature to help customize how inline accessories such as valves can be improved.

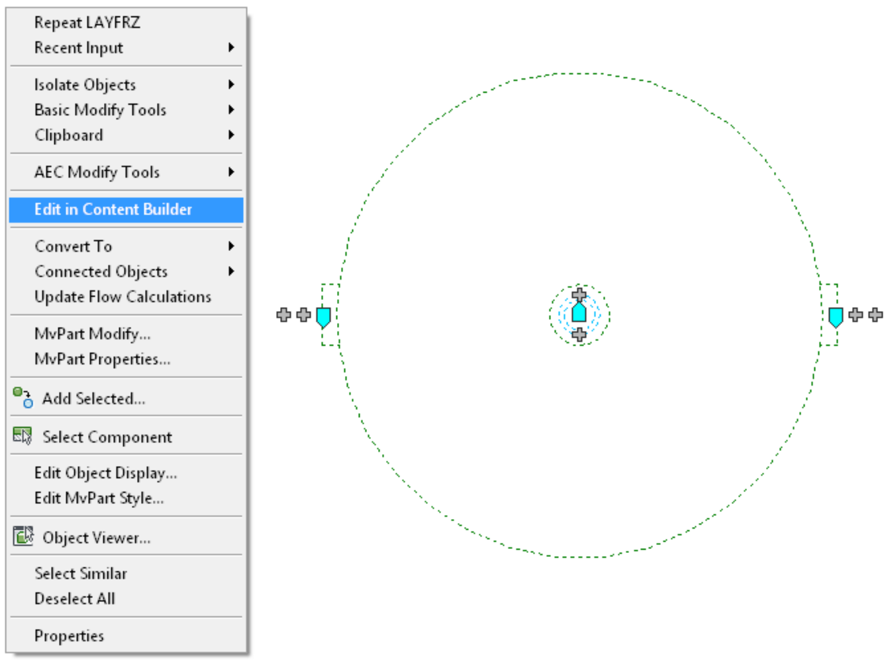
Exercise 5 – Using the Edit in Content Building Tool

AutoCAD MEP 2013 added a new feature that makes editing existing content much easier. The Edit in Content Builder tool is a right click tool that's easy to get to, so let's see how this works.

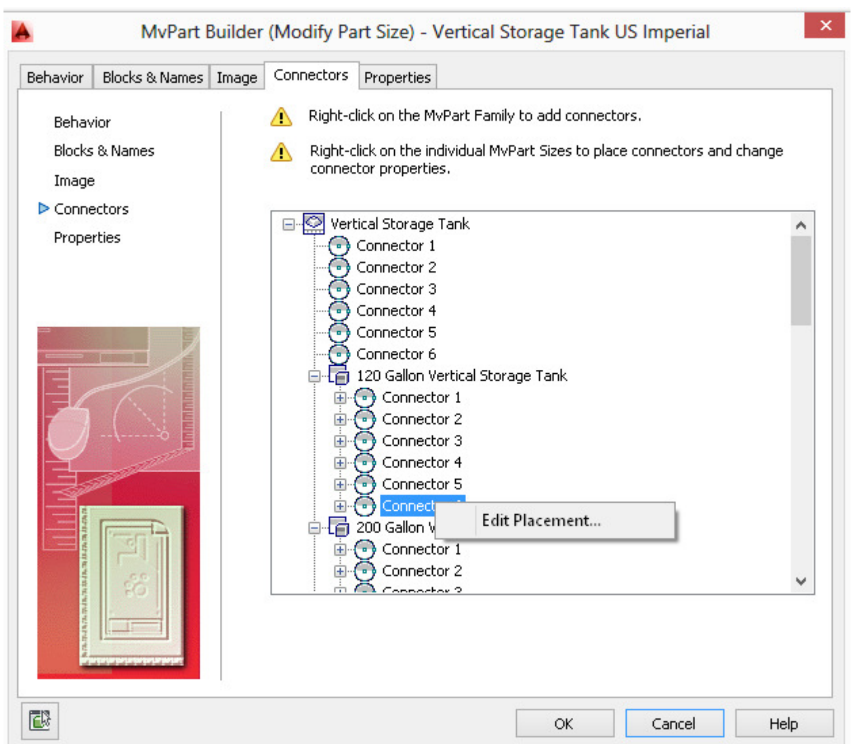
1. Make sure you have the **Piping Workspace** set current, and the **Process Model** drawing open.
2. From the tool palettes, **Equipment** tab, select the **Vertical Storage Tank**. Place it anywhere in the drawing.



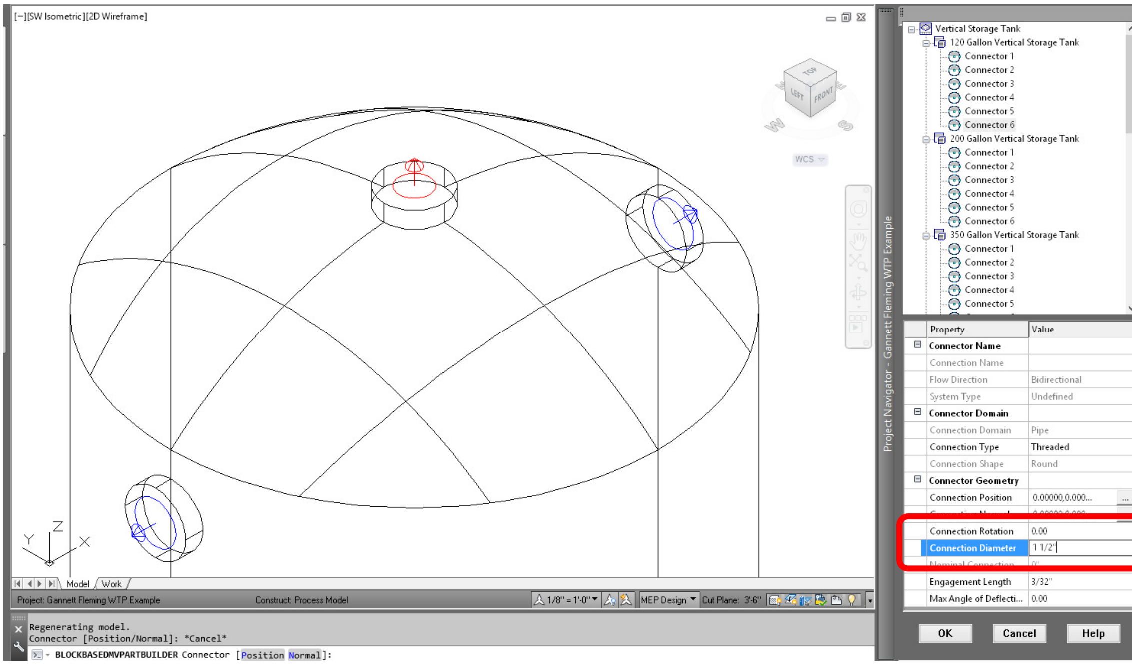
3. Once the tank is placed, select it, and right click. Click **Edit in Content Builder**.



4. This skips the steps of having to open the Manage tab, locate the Content Builder tool, browse to find your part, and then choosing the Modify Part tool.
5. Select the **Connectors** tab. Expand the 120 Gallon tank, and pick **Connector 6**. Right click and choose **Edit Placement**.



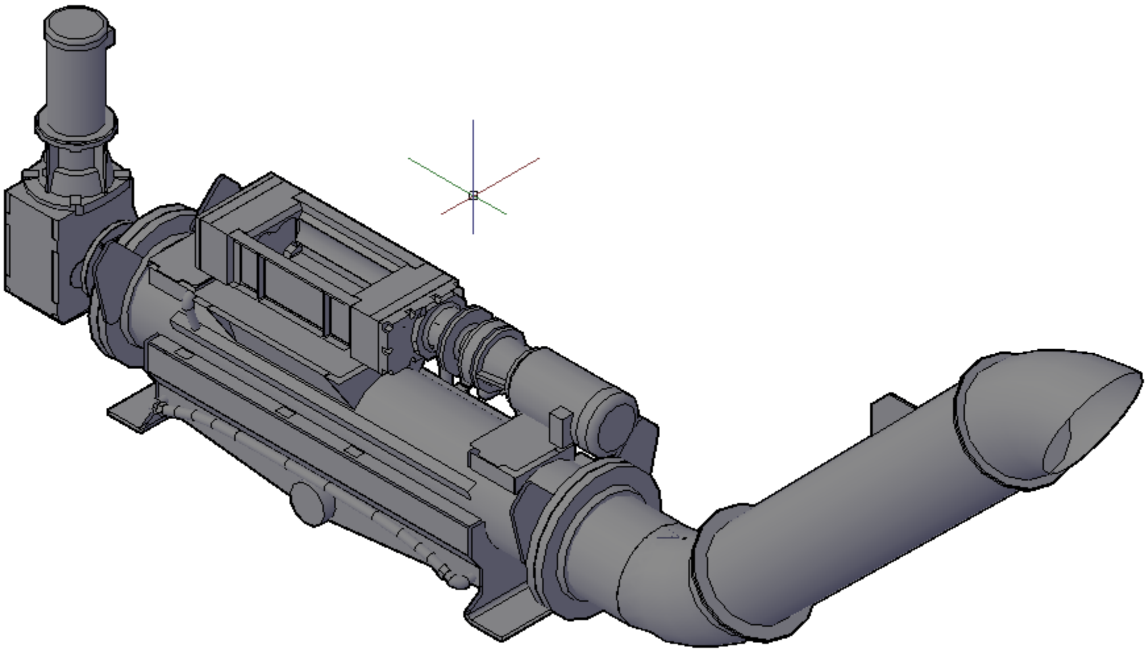
6. The connection editor will appear. **Connector 6** is highlighted in the model. The current size is 2”. Under **Connection Diameter**, enter **1 1/2”.**



7. Click **OK** to close the Connection editor.
8. Click **OK** to close the **Modify Part** dialog. When you return to the drawing, place another tank. The connection is now set to 1 ½”.

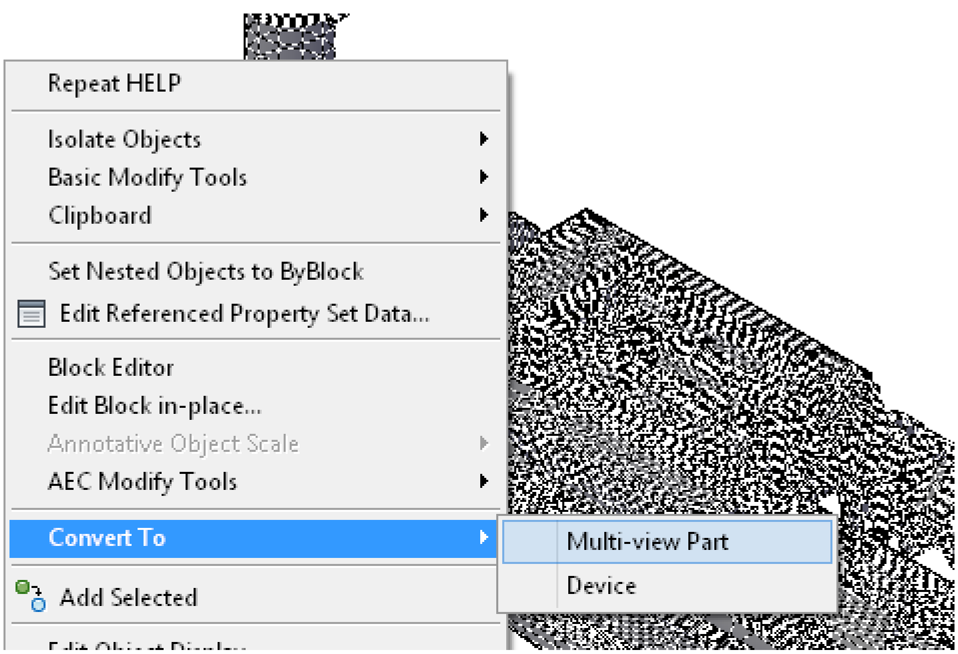
Now *that* was easy.

Exercise 6 – Converting a Manufacturer Part to an MVPart

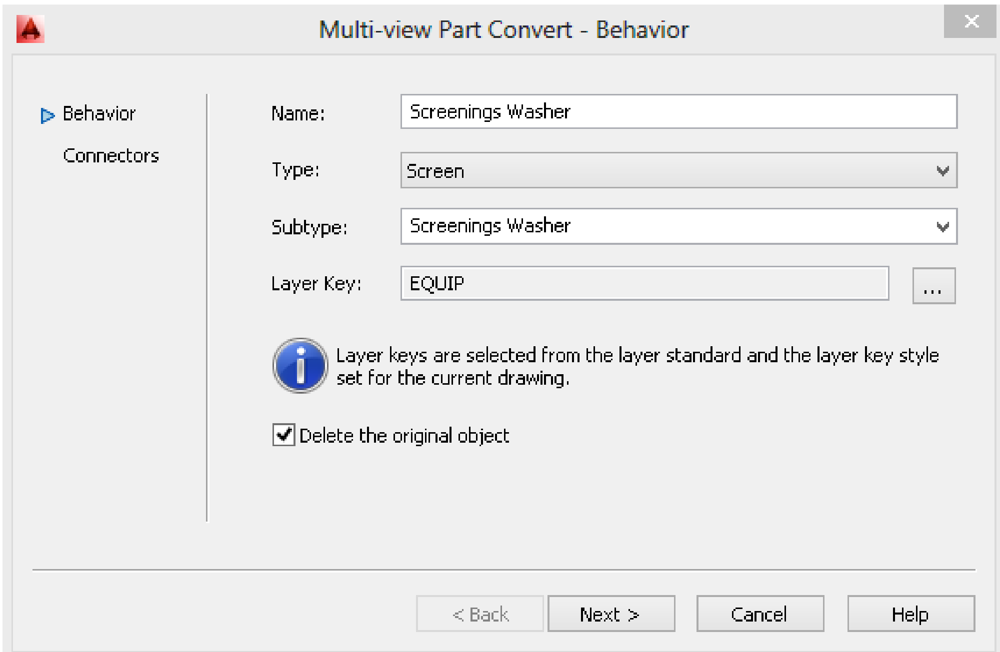


In this exercise, we'll take a 3D DWG that was converted from an SAT file using Fusion 360, and turn it into an MVPart.

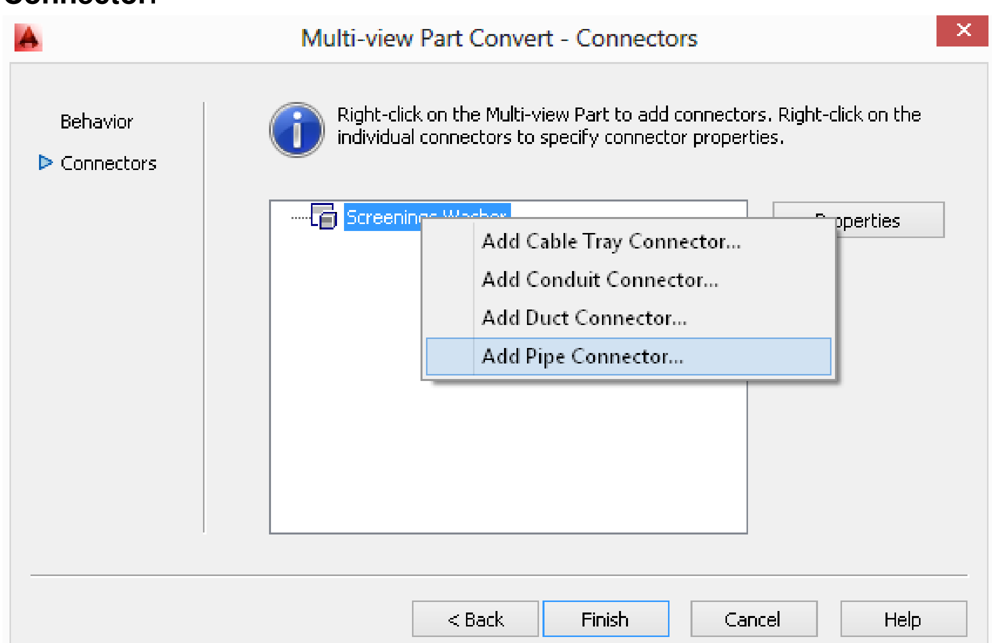
1. From the **JWC Screenings Washer** drawing, select the solid. Right Click, and choose **Convert > Multi-View Part**.



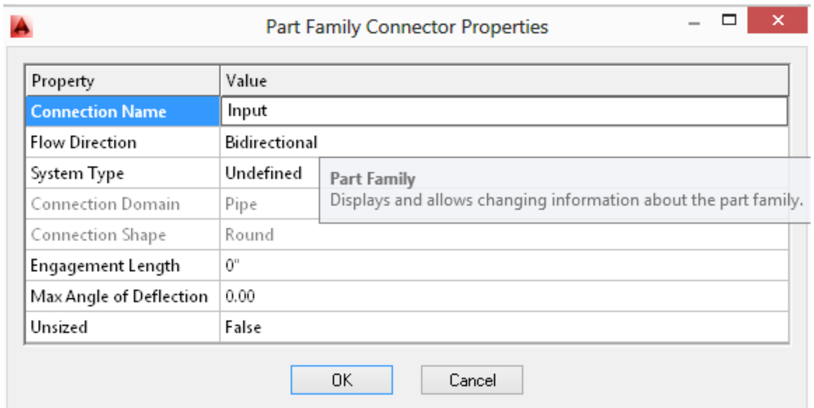
2. For the name, enter **Screenings Washer.** Set the type to **Screen**, and enter **Screenings Washer** for the subtype. You can edit the subtype, but not the type. Set the layer key to **EQUIP**. Select the **Delete the Original Object** option.



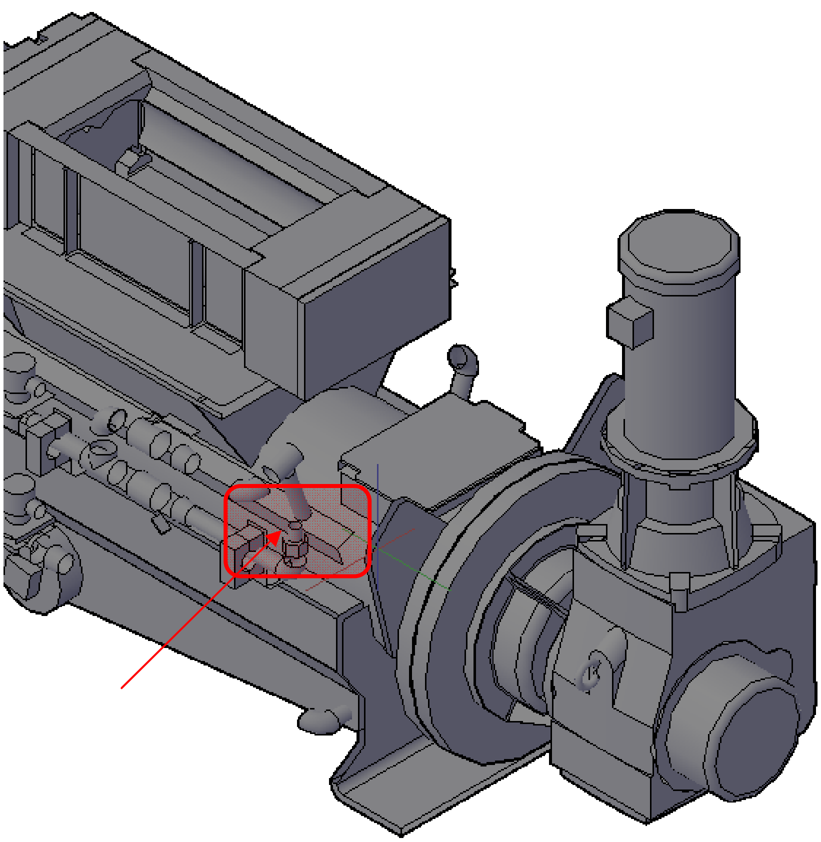
3. Click **Next.** On the **Connectors** page, right click on the part and choose **Add Pipe Connector.**



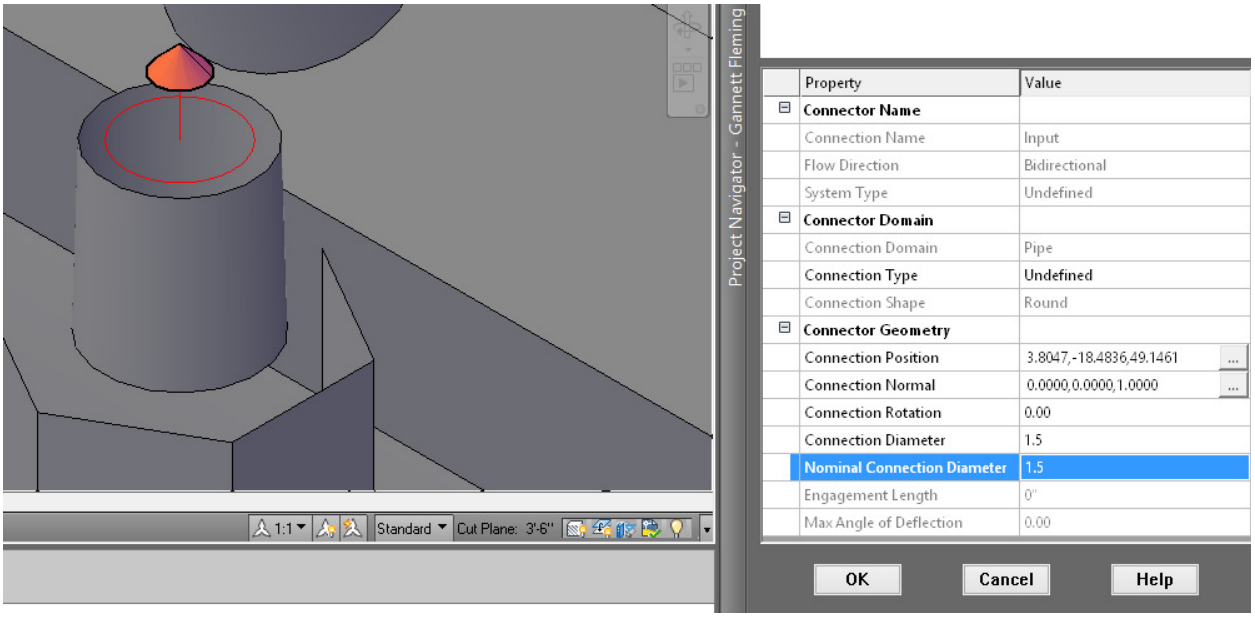
4. For the properties, name the connector **Input**. Click **OK** to continue.



5. Right click on the connector and choose **Edit Placement**.
6. Rotate the part to see the washdown connection. Note – some surfaces may get lost in translation. Items created as weldments, or mesh surfaces, sometimes can't be converted….but fixing that is for another day in Inventor.



7. Select the **placement** icon, and pick the **center** of the connector. Next, change the **normal** so it reads **0,0,1** and points up. Set the **size** to **1.5**”.

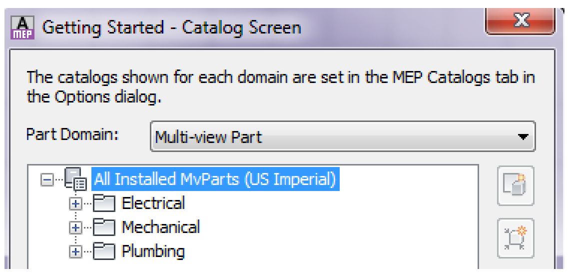


8. Press **OK** to close the connection editor.
9. Click **Finish** to close the dialog, and then take a look at the part. You now have an MVPart that can be scheduled, and follow the display configuration rules. Nice!

Exercise 7 - Adding and Editing Symbols and Annotation Planes to Valves

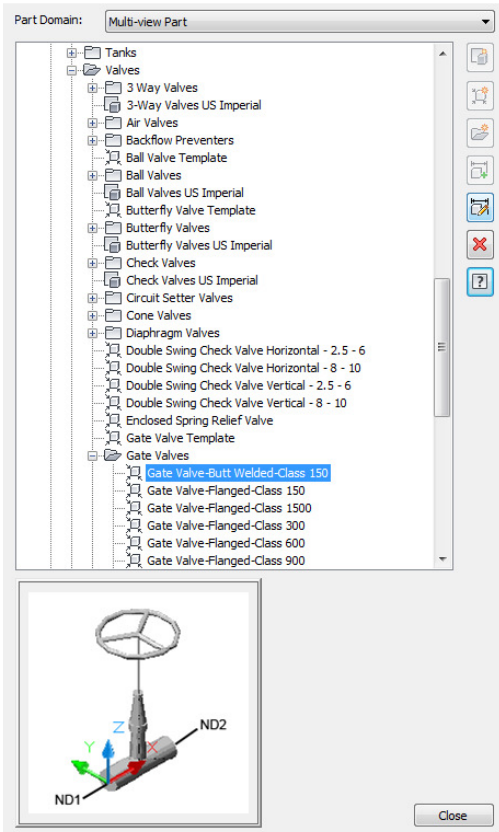
Working in 3D gives you the advantage of seeing your design from different viewpoints. IT also helps to create section and elevation views automatically. AutoCAD MEP includes a feature that makes the engineering models provide clearer detail levels for specific parts. This feature is the ability to add front and left side working planes, and create custom 2D schematic symbols. Let's take a look at how this works.

1. Start a new drawing from the **AECB Model** template.
2. On the ribbon, **Manage** Tab, **MEP Content** Panel, select the **Content Builder** tool.

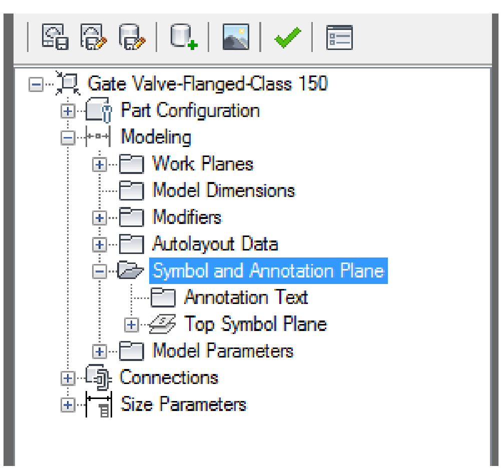


We're going to edit an existing valve, and add the graphic symbol to the front view of the model.

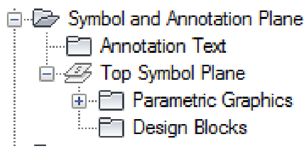
3. When the dialog opens, make sure the **Part Domain** is set to **Multi-View Part**. Under the **Mechanical Equipment** section, browse to valves; expand the section, and then select **Gate Valves.** One note: look for the symbol that has three arrows pointing to a box. This indicates that the part is a block-based part.



4. Select the **Gate Valve-Butt-Welded-Class 150** part. Click the **Modify Part Size** icon to continue.
5. The file will be opened, and the **Content Builder** dialog will appear. The default view is for a plan view, so let's take a look at how the current plan symbol is displayed. On the dialog, expand the **Modeling** section, and then expand the **Symbol and Annotation Plane** section.

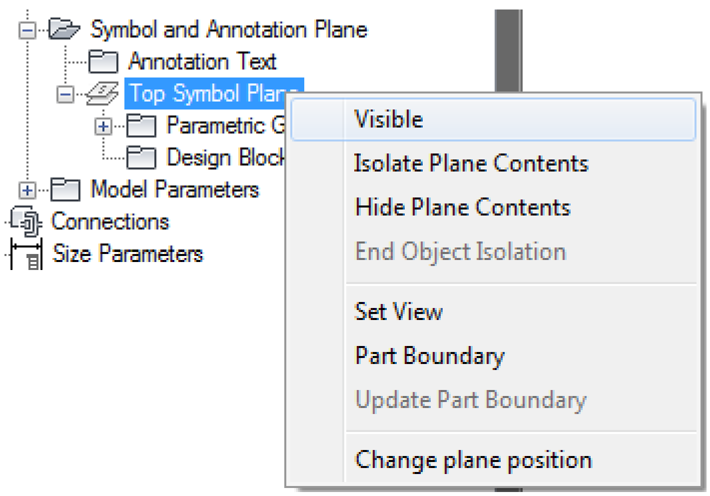


6. Expand the **Top Symbol Plane**. You'll see two categories:

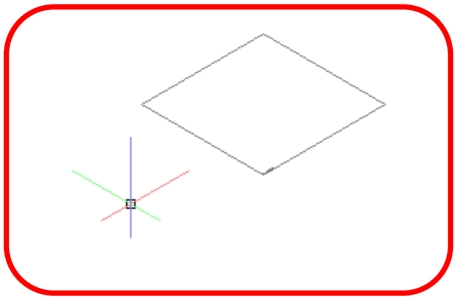


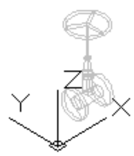
- **Parametric Graphics** allows you to create your own 2D symbol, and leverage the existing model to define your part.
- **Design Blocks** allows you to import a 2D Symbol block and lets it be used to represent the part in the plan, or in the front or left view planes.

7. To add our own symbol, the first important step is to turn on the workplane. Right-click on **Top Symbol Plane**, and click **Visible**.

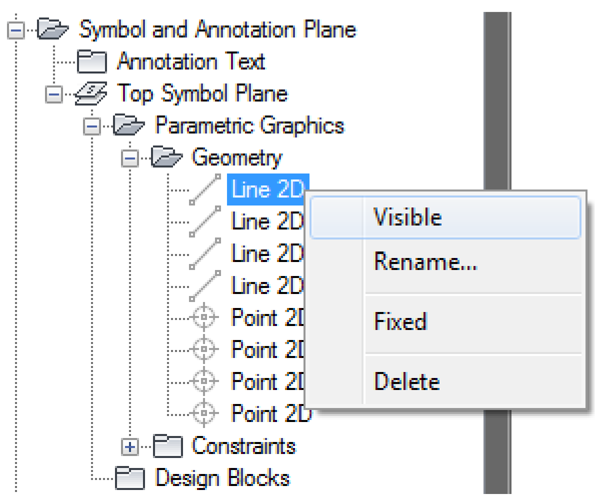


8. This will show the working plane. Use the view cube see where the plane is located in the model:

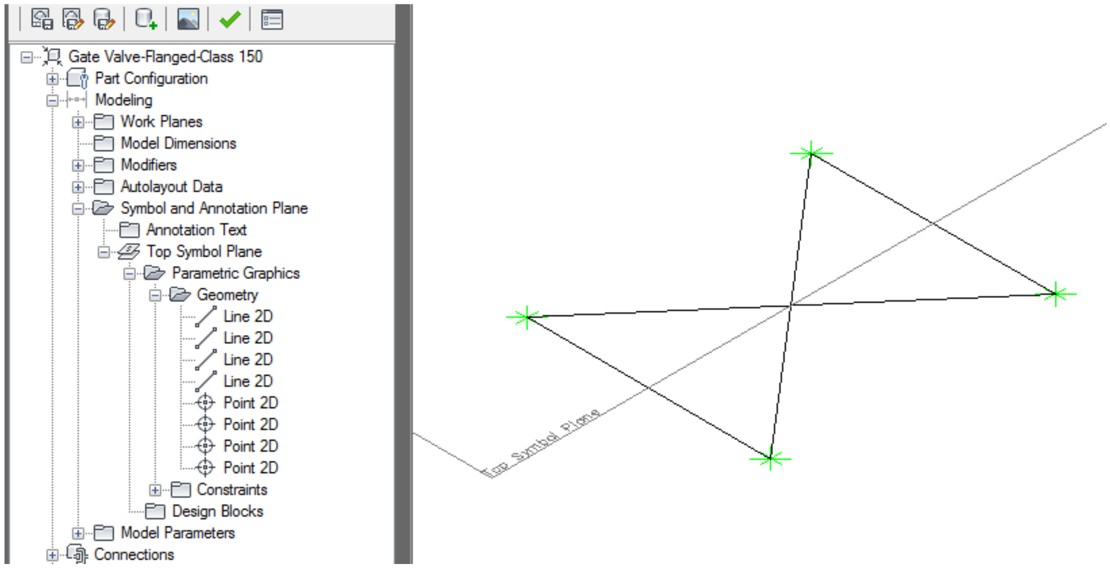




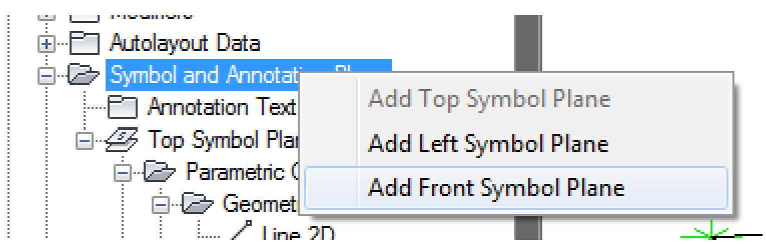
9. As an example, let's check out the existing 2D geometry. Expand the **Geometry** section and then right-click on the first **Line 2D.** Click **Visible** to turn this on.



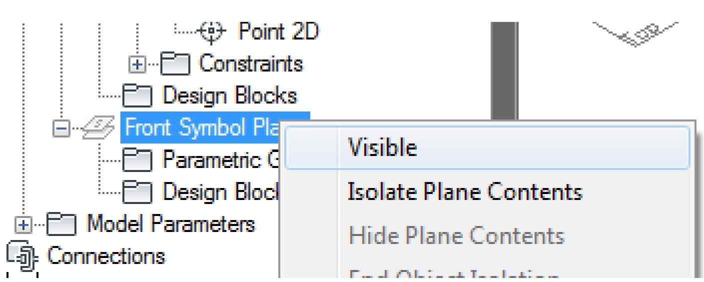
10. To see the rest of the parts, repeat the steps for all of the lines and points. Note how the icon becomes bold as the line or point is made visible:



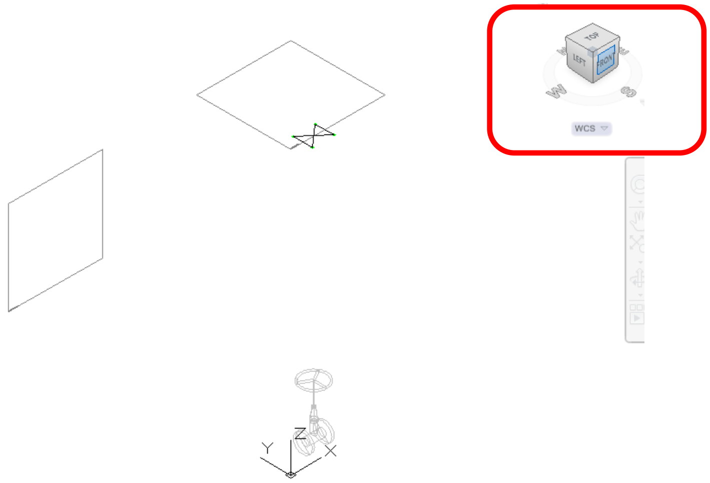
11. This displays the linework that is used when the view is set to the top plane, which is where plan views are displayed. Our next step would be to turn on the **Front Symbol plane** and use it to define a symbol for that point of view.
12. Right-click on the **Symbol and Annotation Plane**. Click **Add Front Symbol Plane**:



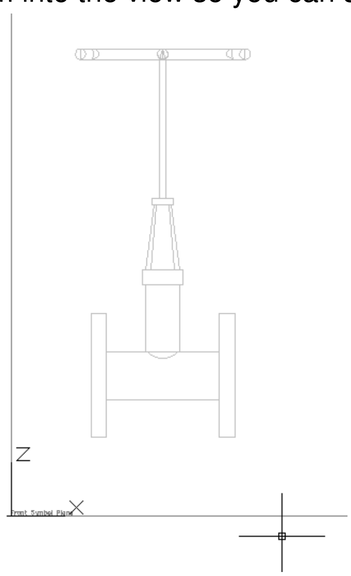
13. Once the plane is created, right-click on the new plane, and then click **Visible** to turn it on.



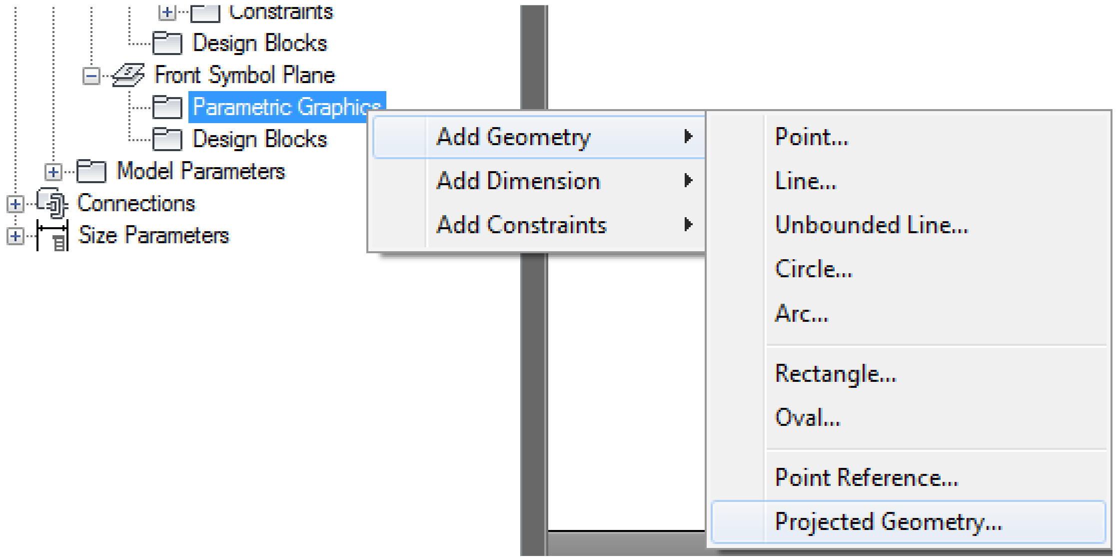
14. Once it's visible, you can change to the front view.



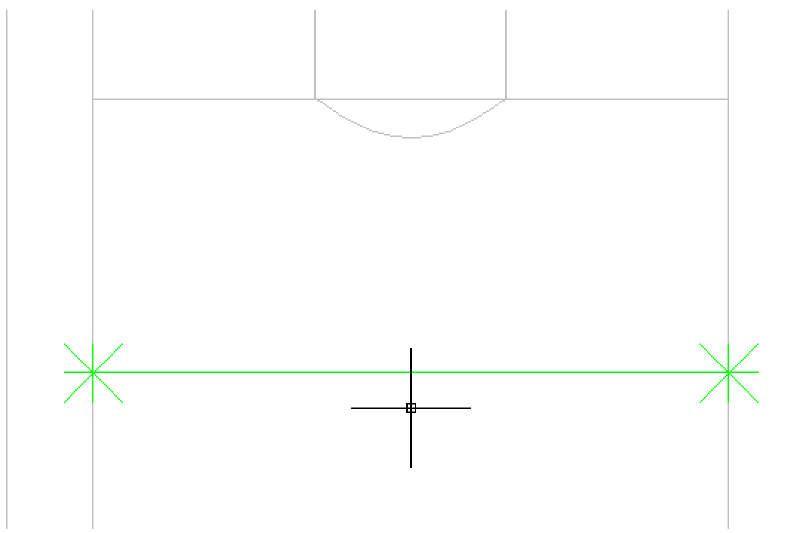
15. Zoom into the view so you can see what you're adding.



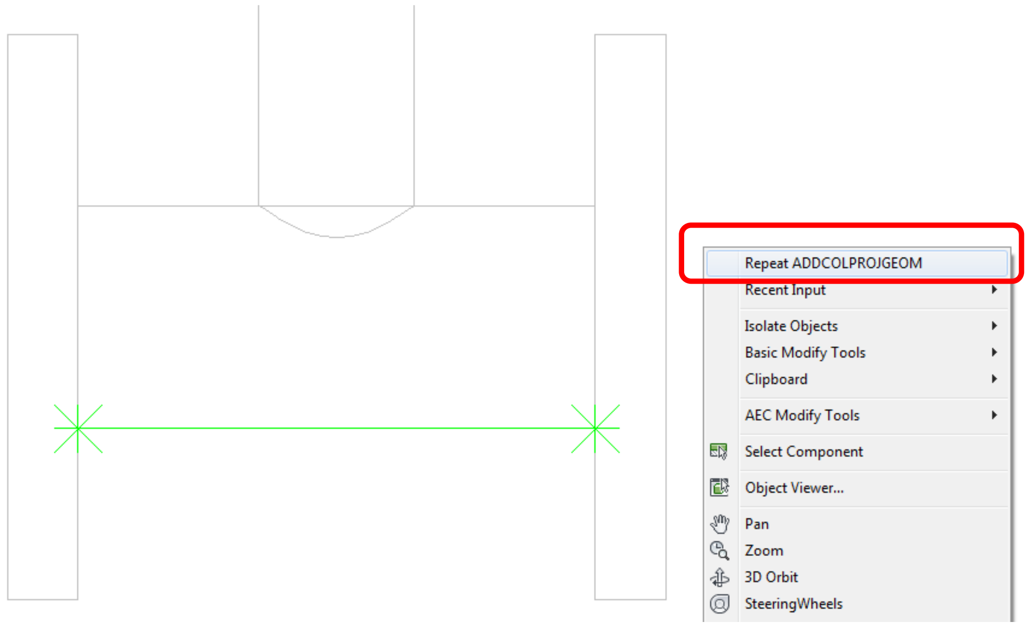
16. In order to link the geometry from the model to the symbol, you need to create **Coincident Points.** These points link the symbol lines you create to the size of the model. The quick way to create the reference points needed to link the new linework to the model is to use the **Projected Geometry** tool. Right-click on **Parametric Graphics,** and then click **Add Geometry.** Once the section expands, select the **Project Geometry…** tool:



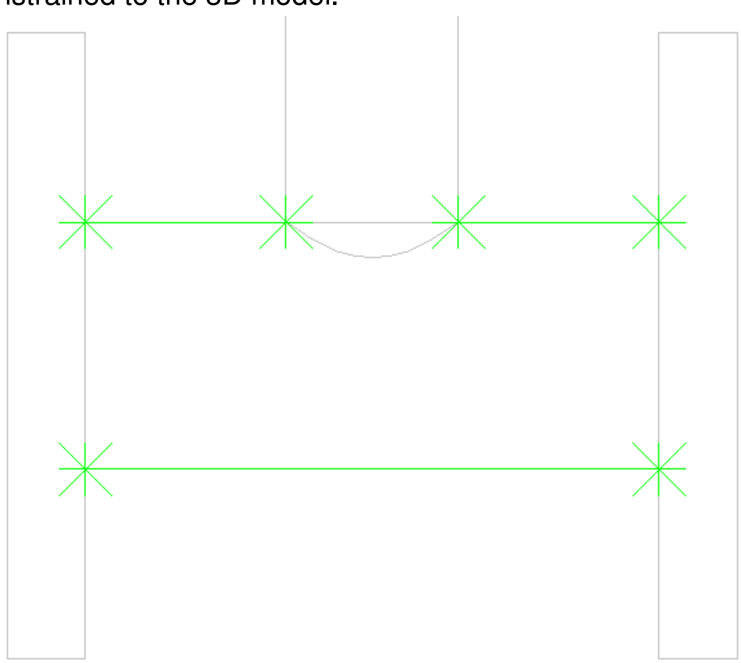
17. You'll be prompted to select a modifier – this is the body of the valve. Pick the shape; as you move your mouse around the body, you'll see a green preview line, which indicates which edge is being used to create the line and points. Select the bottom of the body:



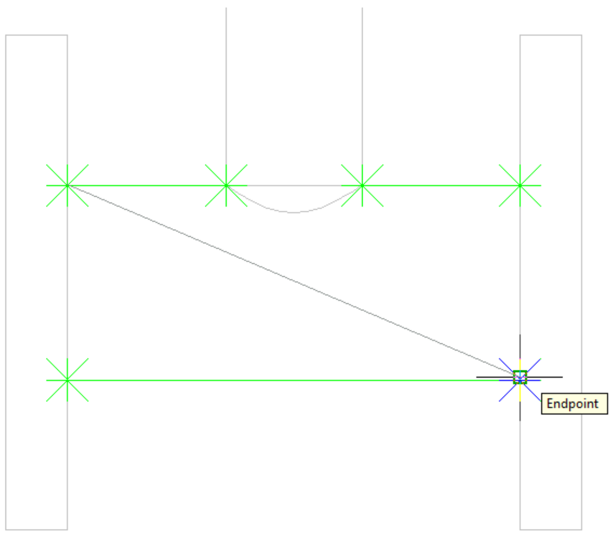
18. The line and points will be created.
19. Repeat this tool by right-clicking in the view, and selecting the **Repeat ADDCOLPROJGEOM** *tool*.



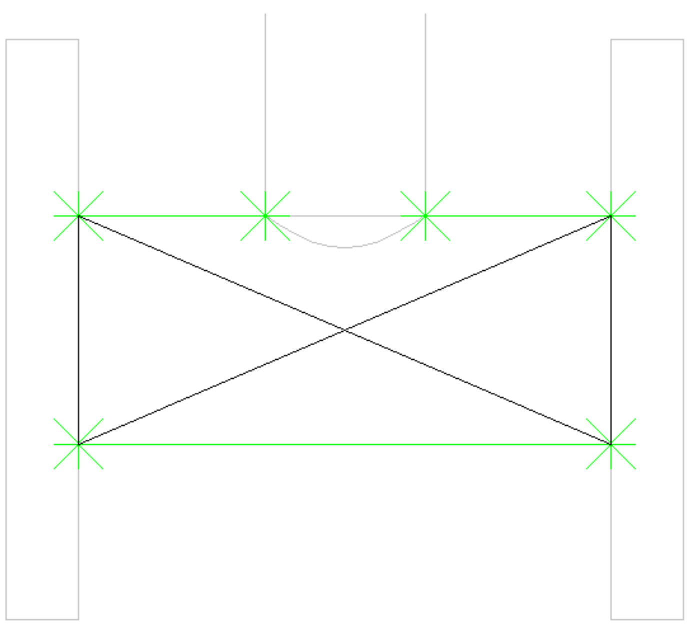
20. Select the two lines on either side of the top of the valve body, as shown here. Once you've added all three lines, you'll have the points you need; and they are automatically constrained to the 3D model.



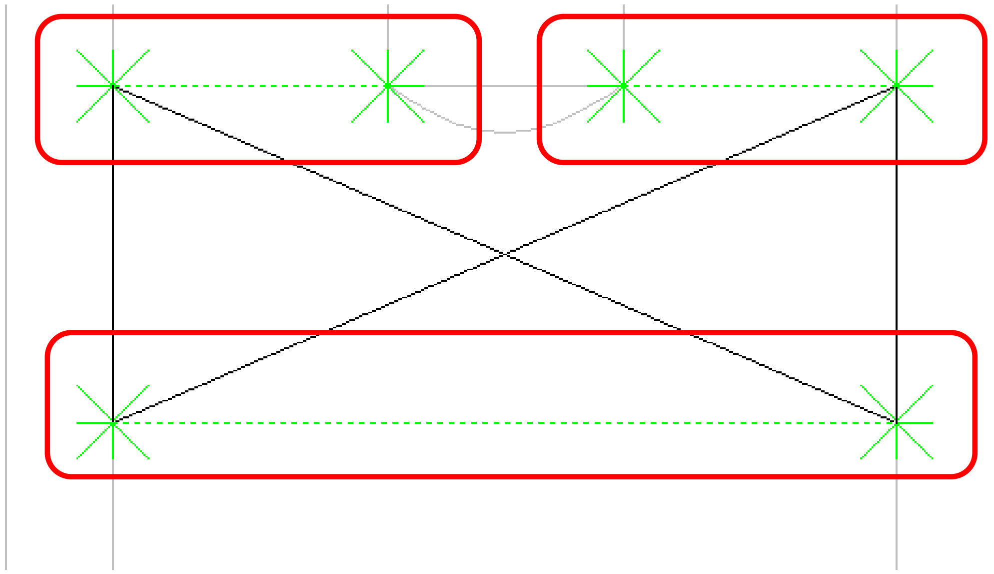
21. Next, right-click on **Parametric Graphics** under the **Front symbol Plane**, and then click **Add Geometry**. Select the **Line…** tool. Using the points as snap points, draw the four lines as shown to create the symbol.



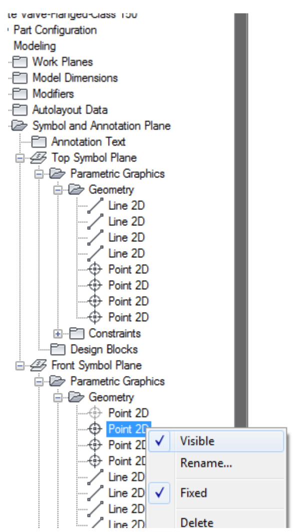
22. Make sure you have the **Ortho** tool turned off. The linework will be created similar to a polyline. When finished, press **ENTER** to complete the command.

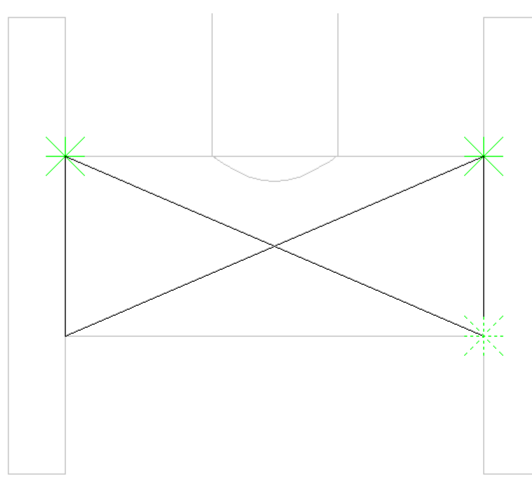


23. You can delete any lines or points that aren't needed to create the symbol, so delete the highlighted below. Pick each segment or point and then use the **DEL** key to remove them.

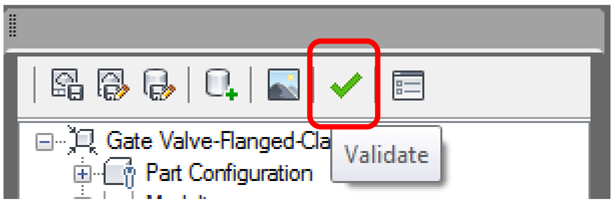


24. The remaining points that constrain the lines to the model can be turned off. By the way, don't delete these; the symbol will not work correctly if you remove them from the model. To hide them, expand the **Geometry** section and then right-click on each point. Deselect the **Visible** option, and the point will be turned off. Notice that these are fixed, which means they are properly constrained to the model.

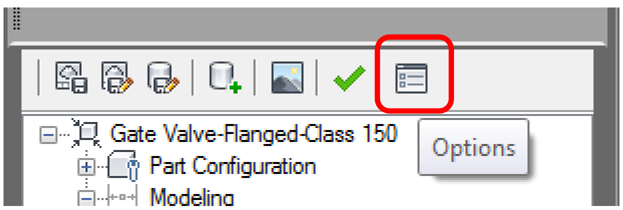




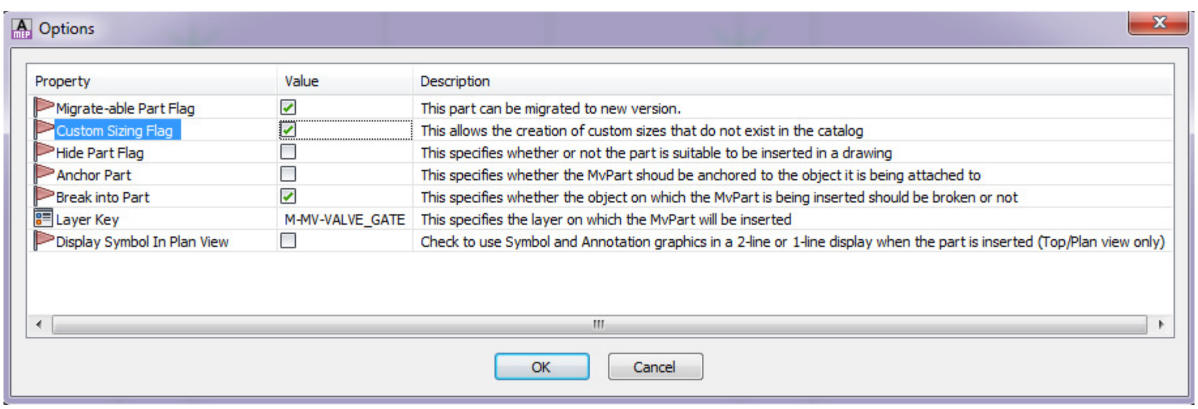
25. The symbol is ready to use, but you aren't finished yet. On the Content Builder dialog, select the **Validate** tool.



26. If there are any errors in the model, they will show up here. Make sure the check mark is **green**, and your model is correctly defined. Select the **Options** tool.



Make sure the following options are checked:



- **Migrate-able Part Flag** – so you can upgrade this to new releases;
- **Custom Sizing Flag** – so you can add custom sizes

27. AutoCAD MEP lets you assign the **layer key** from this dialog. Previously, you had to edit this setting with the Catalog Editor. Make sure the ***Display symbol in Plan View*** is deselected, so the new symbol does not appear from the top view.

You've finished the task now and properly defined the symbol. Close the **Content Builder** dialog, saving the changes when prompted. You can now load the valve into a drawing, and test it to make sure it works. Use this tool to get the construction documents looking the way you want!

Conclusion

Hopefully you've had a chance to look at some non-traditional procedures and tools that can help refine your projects, and provide more detail. If you wind up working in a multiplatform environment, the steps we've covered should make them run much smoother. For more help down the road, keep up with my blog at mepd-cad.blogspot.com, or 4D Technologies CADLearning series on AutoCAD MEP, which I've authored for the past few years.

Happy BIM'ing!