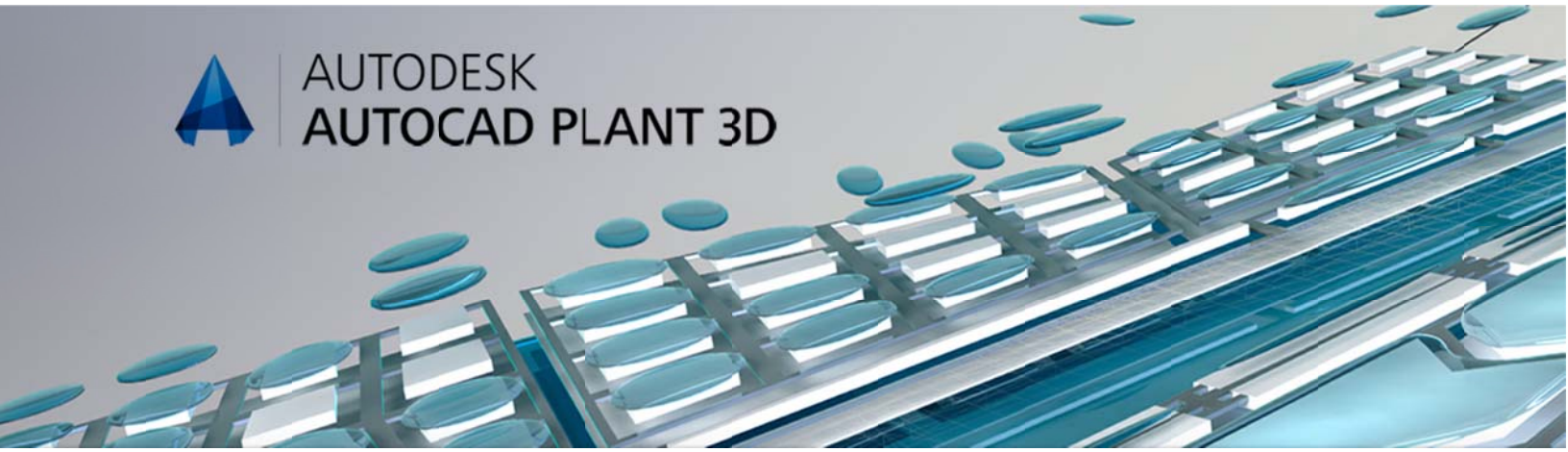
AUTODESK.



Autodesk AutoCAD P&ID 2014

Advanced Configuration Guide

Administrator Training

Contents

Chapter 1: Project Configuration

Project Files

Each project has one of each of these files:

- Project.XML
- PnIdPart.xml
- ProjSymbolStyles.dwg
- SubstitutionPalettes.xml
- ProcessPower.dcf
- ProcessPower.dcfx
- Piping.dcf
- Piping.dcfx
- PipingPart.xml
- Iso.dcf
- IsoPart.xml
- Misc.dcf
- MiscPart.xml
- Ortho.dcf
- Ortho.dcfx
- OrthoPart.xml

- Various Report Templates Directory
    - ControlValve.XML
    - DocumentList.XML
    - EquipmentList.XML
    - InstrumentationIndex.XML
    - LineList.xml
    - LineSummary.XML
    - NozzleList.XML
    - ValveList.XML

All drafters working on this project will share these files. There files are copied from the project selected as the source project when the project was created. The source project can be any project. We ship five “template” source projects called PIP (imperial and metric), ISA, ISO, and DIN.

Once you start working, the data cache is created – one per project. These cache files are:

- ProcessPower.dcf
- ProcessPower.dcfx
- Iso.dcf
- Iso.dcfx
- Misc.dcf
- Misc.dcfx
- Ortho.dcf
- Ortho.dcfx
- Piping.dcf
- Piping.dcfx

If a project is using SQL Server, the *.dcf files are not databases, but xml connection files which point the program to the correct SQL Server database.

The first time a substitution palette is invoked, you also get a project file called SubstitutionPalettes.xml

Read-Write Issues

PnIdPart.XML needs to be writable by all drafters creating content in this project. (i.e., anyone using the program to draw P&IDs). This xml happens to use “Project Autogen” values for automatic tag generation, the last autogen value is also stored here.

Of course the data cache ProcessPower.DCF & ProcessPower.dcfx files need to be writable if you are creating content.

The other project files can be read only by drafters creating content in this project.

Other Files Important to the Project

The DWT (drawing template) file can be either shared from some project directory OR on each user’s workstation. The project.xml points to the DWT, and this path can be either local or network. Out of the box it is where all the other ACAD DWT files - C:\Users\%USERNAME%\AppData\Local\Autodesk\AutoCAD Plant 3D 2015\R20.0\enu\Template

Undoubtedly many projects will want the TOOL PALETTE to be from a shared project file instead of from the local copies in each user’s C:\Users\%USERNAME%\AppData\Roaming\Autodesk\AutoCAD Plant 3D 2015\R20.0\enu\Support\ToolPalette

PnIdPart.XML contains

- Project NAME, DESCRIPTION
- Paths to the REPORT xml files
- Auto-gen definitions
- Path to this project and project files (ProjSymbolStyles.dwg)

- Path to DWT file

ProcessPower.dcfx is the schema structure. It contains

- ALL the CLASSES (like EQUIPMENT, PUMP, HandValve, GateValve)
- PROPERTIES for these classes. (like MANUFACTURER, Size, Service) including if this property is a number, text, election list.
- Display Names for the CLASSES
- Default values for the PROPERTIES.
- If the property is a selection list, what list to use.

ProjSymbolStyles.DWG contains

- The symbols (blocks) assigned to the classes
- Any annotations
- Tag format definitions

The various report templates contain info on what properties to display in the report. This includes the JOINS, FILTERS, SORTS, and selected PROPERTIES.

The ProcessPower.dcf file is a database that contains all the data records.

Summary of Access Rights

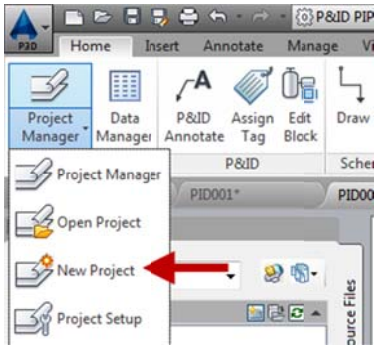
Project Files	Read Access	Write Access
• Project.XML		User
• PnIdPart.xml		User
• ProjSymbolStyles.dwg	User	
• SubstitutionPalettes.xml		User
• ProcessPower.dcf		User
• ProcessPower.dcfx		User
Images		
ReportTemplates	User	

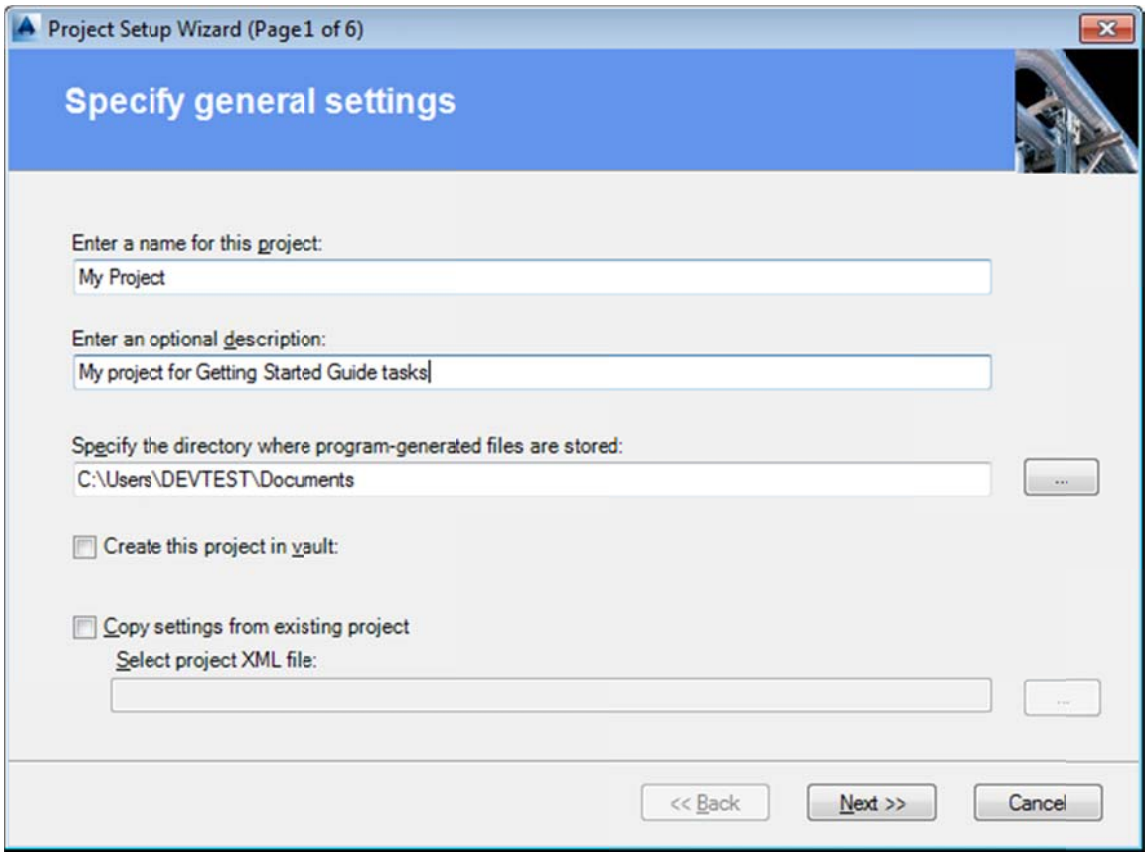
Chapter 2: Project Setup

Create a Project

Create a new project to use as the default for the exercises you'll perform in this book.

Click New Project from the Project Manager drop down in the ribbon.

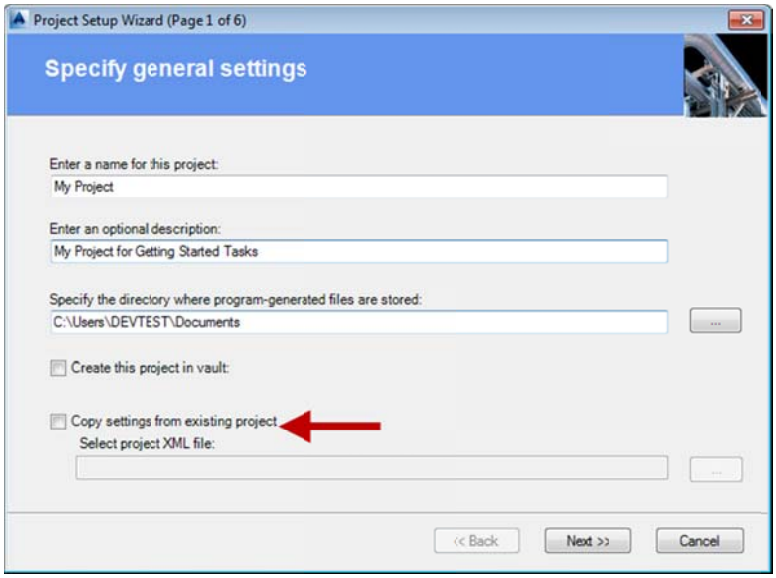




In the Project Setup Wizard, enter these values:

- Name – **My Project**
- Description – **My project for Getting Start Guide tasks**

Notice that you can copy settings from existing project.



Keep clicking next to accept the default settings for Symbol set, drawing paths, and database types. Click Finish at the last screen.

Chapter 3: Data Manager

Export/Import

Set Up and Export Reports

You set up reports in the Project Manager. You can export reports either from the Project Manager or the Data Manager, but you view and manipulate reports in the Data Manager.

You can export a report on a project. You have the choice of a number of preset report templates. You can select multiple report types for a single report, in which case, each report type will be on a separate worksheet of the Microsoft Excel spreadsheet. You can export a new report from a template, or copy and rename an existing report.

Reports can also be created externally to AutoCAD P&ID via the report creator application. This application allows you to define a format, and then populate that format with data from your project.

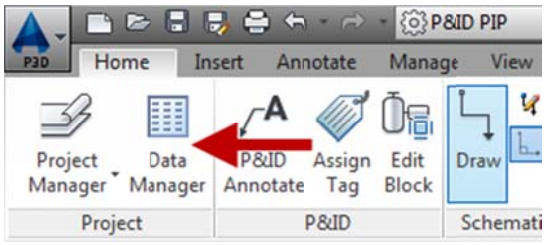
The following list describes the report templates that are provided.

Report Template	Contents
Equipment List	Data about equipment components and what drawing they are in.
Line List	Data about piping segments grouped by line number and what drawing each is in.
Line Summary List	List Data about the pipeline groups and what drawing they are in.
Instrument Index	Data about instruments, what drawing they are in and what they directly connect to, if anything (can be a line, one or more other instruments, or equipment).
Valve List	Data about valves, what line segment or group they are on, and what drawing they are in.
Nozzle List	Data about nozzles, what equipment they are on, what drawing each is in, and what line (segment and group) they are connected to, if any.
Control Valve List	Data about control valves, what drawing they are in, their line number, size, and so on.
Document Registry	Data about drawings in the project.

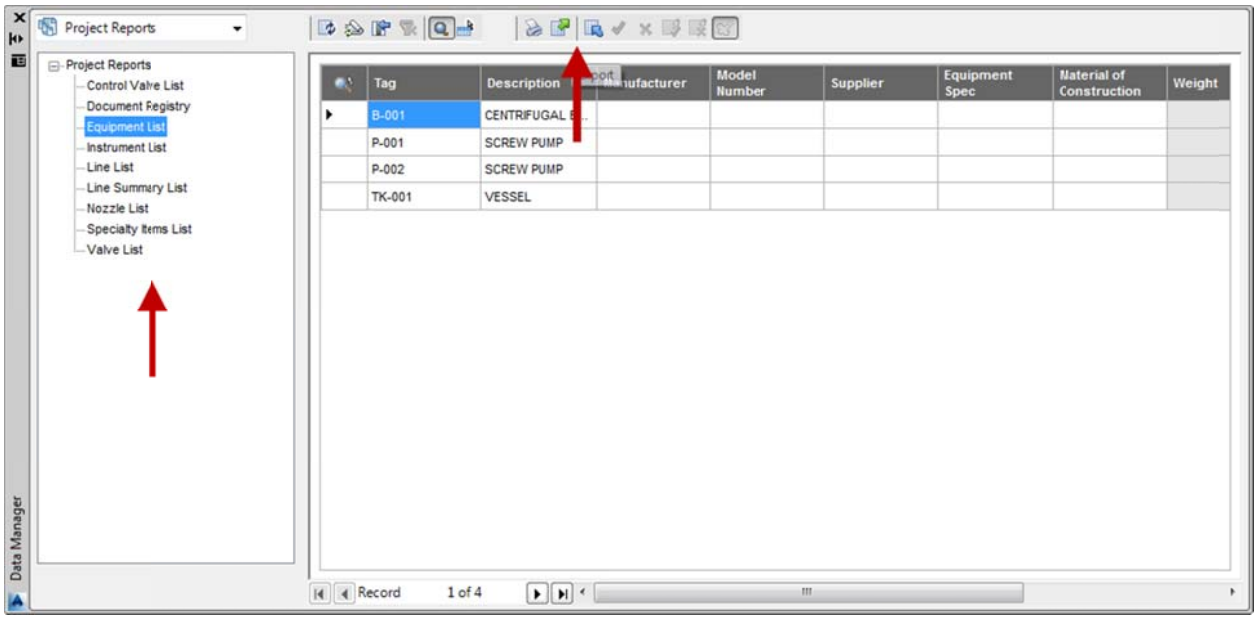
Procedures: Export Reports

To export a report

Open the Data Manager.



In the Data manager, you can select which report should be export and then click the Export button to send it to Excel.



Import Reports and Reconcile Changes

You can import a project report and review the requested changes to data in a previously exported report. You can accept or reject the requested changes.

The Microsoft Excel spreadsheet or comma-separated value (CSV) file you import must use the same report template as the report into which you are importing.

Import Microsoft Excel Spreadsheets

If the spreadsheet does not contain any worksheets that match report types, the file does not import and you receive a warning. If there are one or more worksheets that match a report type, the program imports those worksheets, but ignores any columns with header fields that do not match the report into which you are importing.

Import CSV Files

If the report type of the imported CSV file does not match the report type into which you are importing, the import ignores the content. For example, you select a report type for a Valve List. If you import a CSV file containing an Equipment List, the import ignores the Equipment List report because it does not contain valve data.

Whether dealing with a spreadsheet or a CSV file, you can only import primary table files back into AutoCAD P&ID. For example, a valve list can only import into the valve table; however, it cannot import in a field on joined tables.

View Pending Changes in the Drawing

In a drawing, you can graphically view each component or line that has pending changes before you accept or reject the change, simply by clicking on the row header of the pending change in the Data Manager.

Reconcile Changes

From the imported report, modified values and their corresponding row headers are displayed in yellow highlighting. You can accept or reject changes individually or all at once.

NOTE Tags are read-only entries in project reports. You cannot change tag data in exported spreadsheets or CSV files. If you attempt to accept changes to tag data, a warning message is displayed.

When you accept all changes in the report and you encounter a problem with a pending change, the acceptance process terminates.

You cannot accept changes that are from read-only P&ID drawings; you can only reject them.

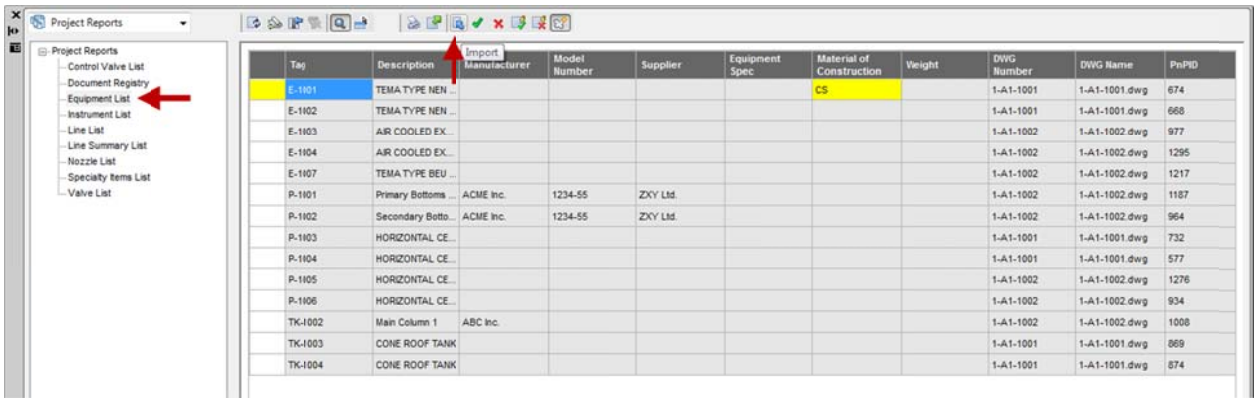
A tooltip shows the original value of a changed field when you hover the cursor over the field.

You can switch to Project Data or Drawing Data mode during data reconciliation for an imported report. When you switch back to Project Reports mode, pending changes are still yellow and you can continue to accept or reject them. Until you have reconciled all pending changes, you cannot edit any of the fields in the report.

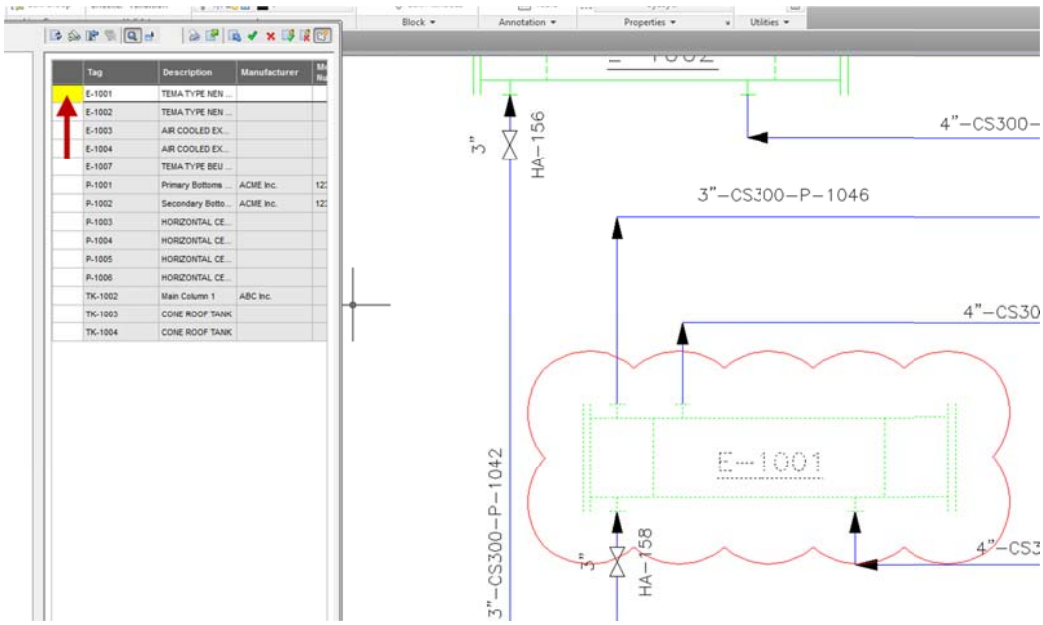
Procedures: Import Reports

To import a report from Microsoft Excel

Open the Data manager. Select the report you wish to import. Click the import button, and browse to the file you want to import. Changes will be highlighted in yellow.

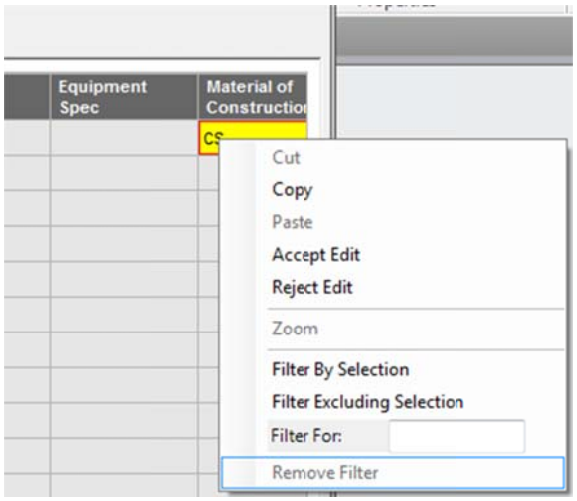


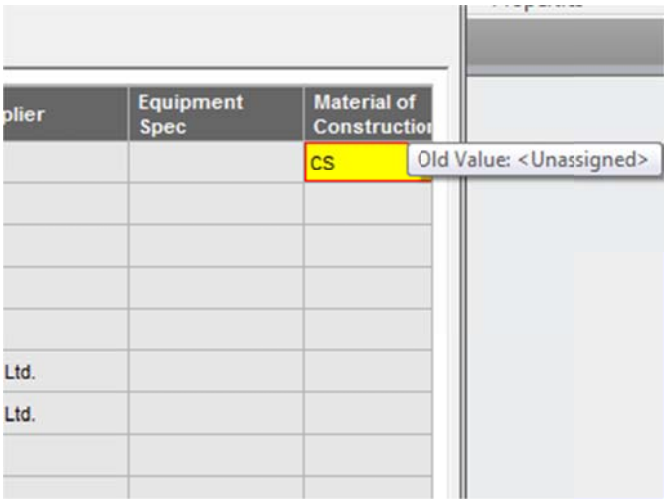
While in the import process, you can locate and view changes by clicking the row header. AutoCAD P&ID will open the affected drawing and display a temporary rev cloud around the items with the change.



The change management buttons can be used to accept or reject changes. From left to right, they accept the selected row change, reject the select row change, accept all row changes, reject all row changes, and draw a temporary revision cloud around the changed items in the drawing.

You may also right-click in a cell to accept or reject the change. Previous values may be seen by hovering over a changed cell.





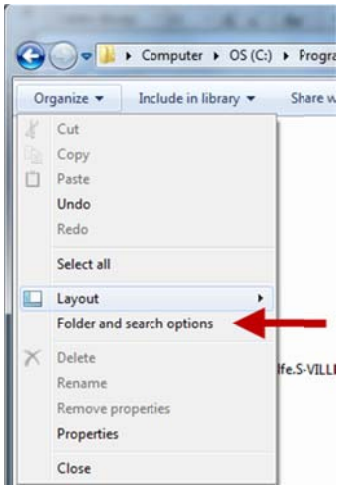
Chapter 4: Project Tool Palettes

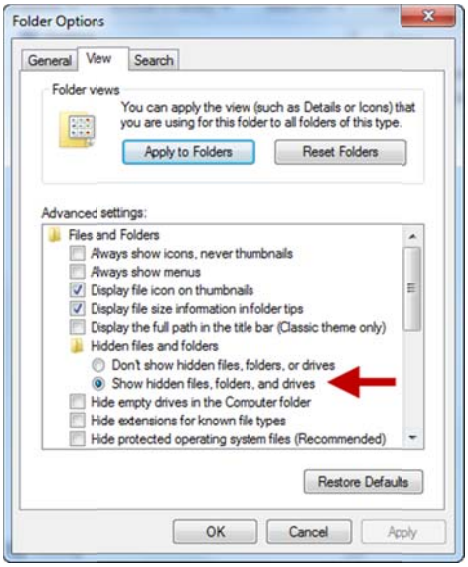
In this procedure, you will create tool palettes on the company network and then path the user profile to use those palettes. The palettes will be set to read-only so that only the administrator may change the palettes on the network.

Copy the default tool palettes to the network

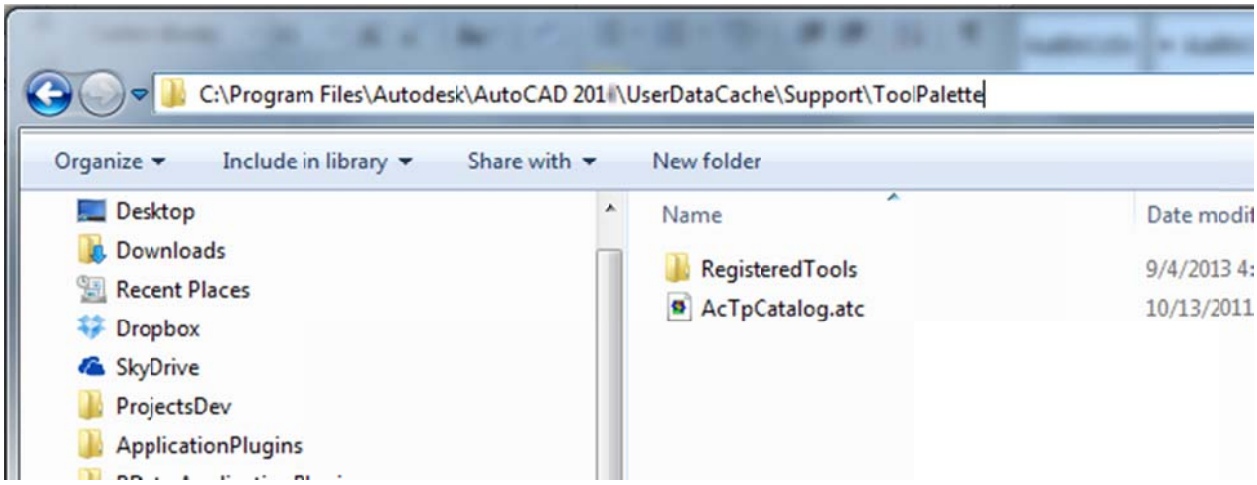
Browse to C:\Program Files\Autodesk\AutoCAD 2015\UserDataCache\Support\ToolPalette.

The UserDataCache folder is a hidden folder. You may need to go to Folder and Search options. Go to the view tab, and make sure hidden folders are visible.



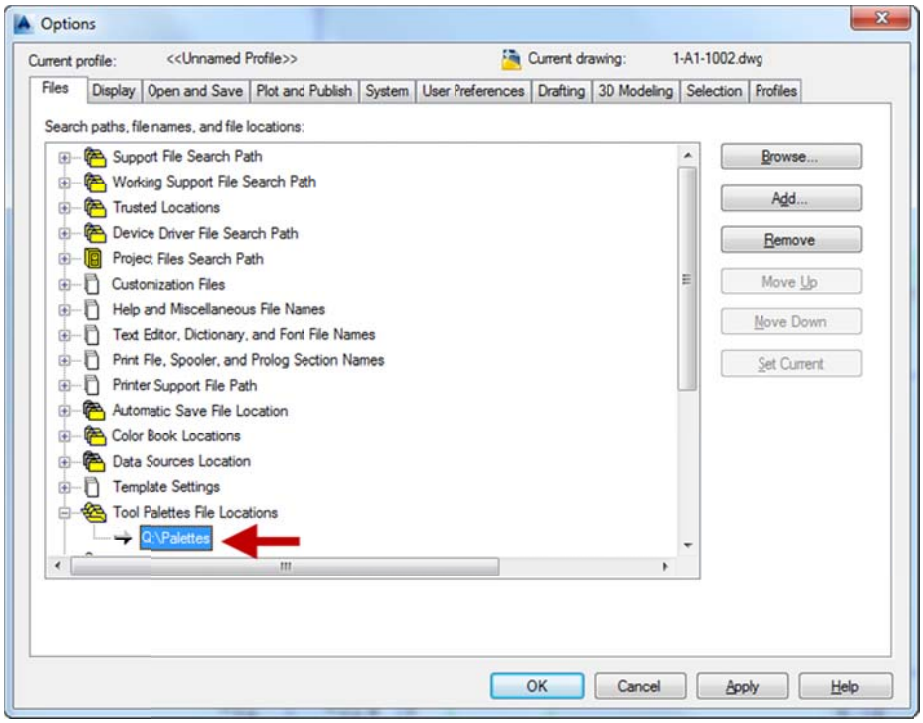


Copy the contents of that folder. Never modify, move or delete the contents, these files are used by AutoCAD to reset user changes.



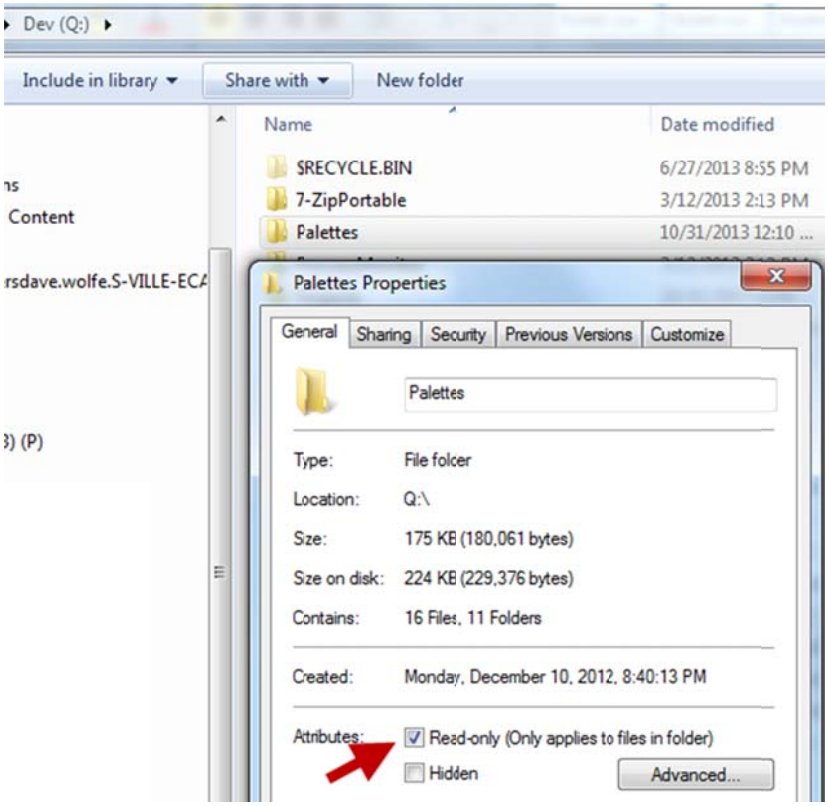
Paste the contents in a folder or your network. For example, paste the contents to Q:\Palettes.

To modify the palettes, open AutoCAD options (OP), and select the Files tab. Navigate to the Tool Palette File locations property, and alter the path to match the new network location.



Once your path is set to this location, add symbols to palettes as you need to. The best practice is to use the existing tool palette groups (PIP, ISA, etc.) and palettes, and organize the new symbols. Otherwise, you may have to do extra admin work updating user tool palette groups for each install.

After you modify the tool palettes inside of AutoCAD P&ID, close the program. Changes to the palettes do not get saved until the program is closed. After the program is closed, navigate to the palette folder in Windows Explorer, right-click it and view the folder properties. Check the read-only box.



When AutoCAD opens and find the read-only attribute set on the palettes, it will display a lock icon on the bottom left corner to let users know the palettes cannot be modified. You can use standard security groups to allow only administrators to uncheck/check the read-only property.

As a rule, the read-only property should always be checked. When the palettes need to be modified, have everyone exit AutoCAD, uncheck the read-only attribute, and then open AutoCAD to make the changes. Once you have close the program to save the changes you made, set the read-only attribute back to true before having everyone resume their work.

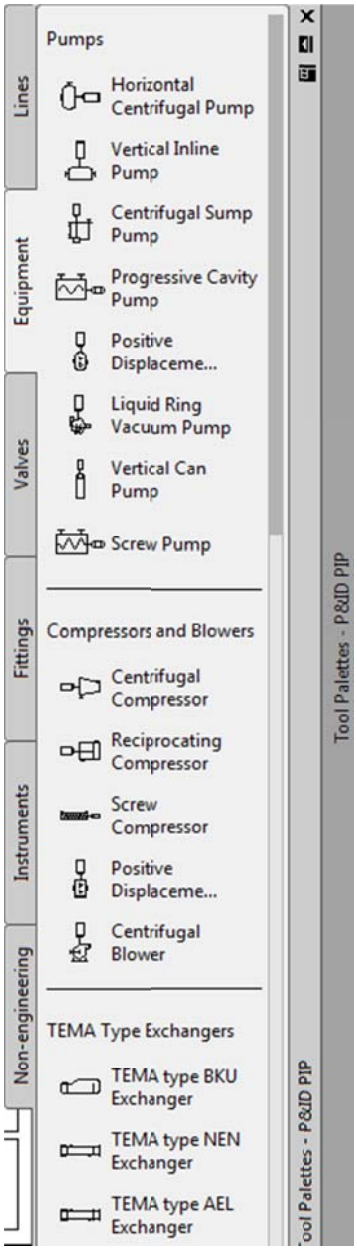
Chapter 5: Project Customization

Symbols

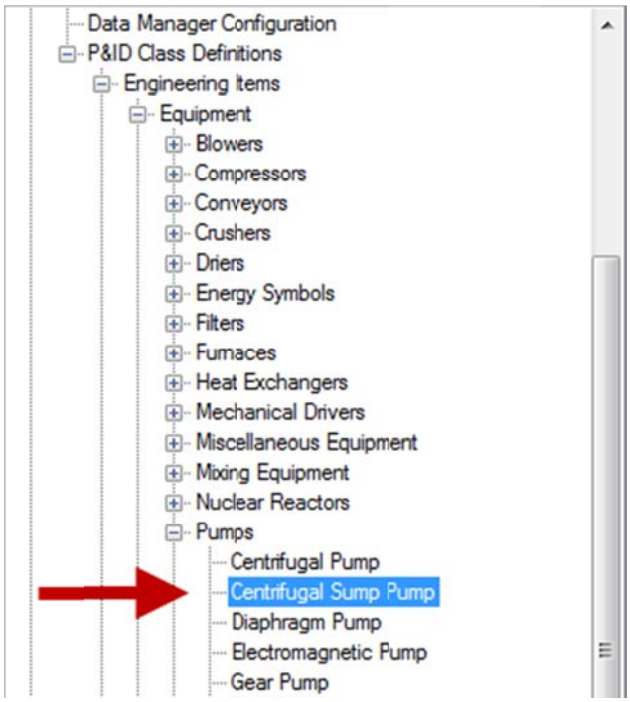
Create a pump from an existing pump

In the following procedure, you create a new pump from an existing pump, change the class definitions for the new pump, and then add the new pump to the Equipment tab of the tool palette. This is just one way you can add new components and lines to your library of symbols.

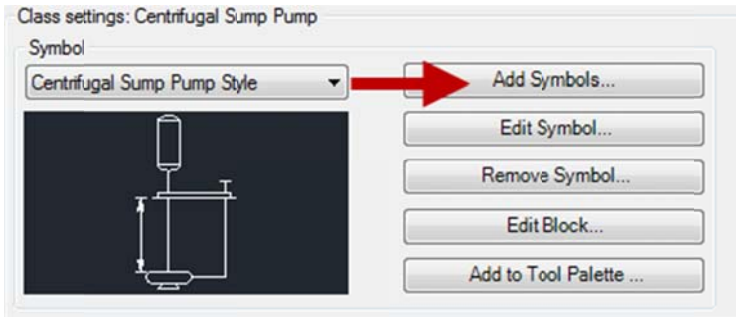
Navigate to the Equipment tool palette. We will add a pump to this palette, so it needs to be current.



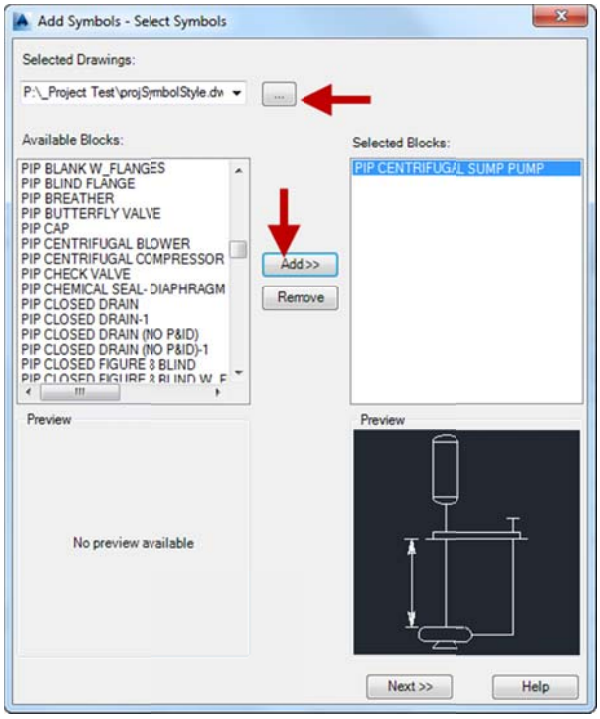
Start project setup, and navigate to the Centrifugal Sump Pump class.



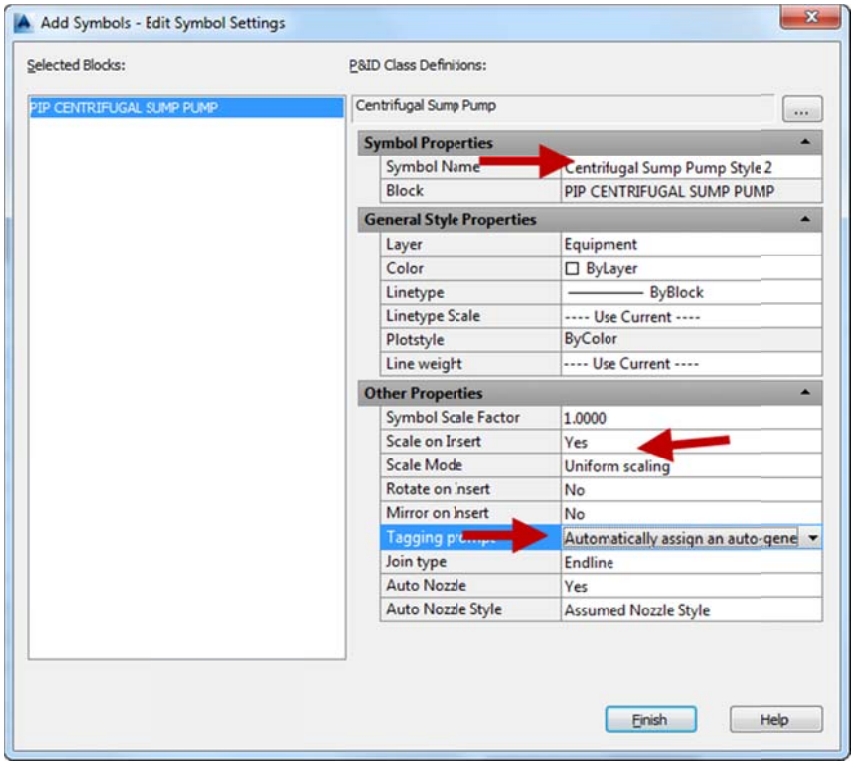
Click Add Symbols.



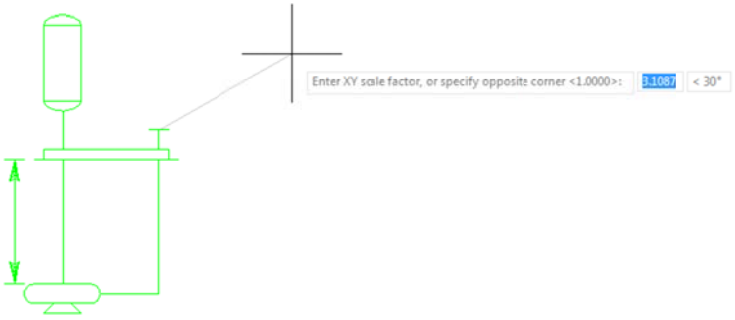
Browse to the current project's projsymbolstyle.dwg, select the PIP Centrifugal Sump Pump block, click Add and then Next.



Set Scale on Insert to true, choose automatically assign a generated tag, and name the style **Centrifugal Sump Pump Style 2.** Click finish and note the results in the Style selector. Add the newly created style to the current tool palette.



Click Ok to accept the changes we made. When placing the new symbol in a P&ID, you should get prompted for the scale, but not prompted to enter a tag.



NOTE You can move the pump tool you just added to the tool palette by dragging it and placing it in its new location in the palette. You can also copy or cut it and paste it onto another P&ID tool palette.

Properties

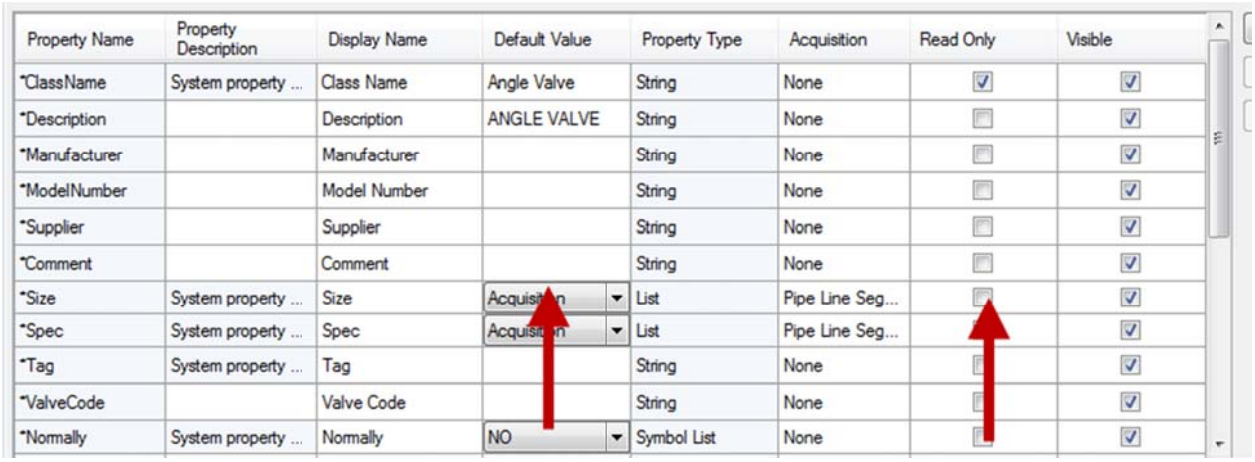
Set up Properties for Components and Lines

Properties are the individual attributes that define a class definition. You can modify existing properties or add custom properties to a class definition.

Class definitions are defined as follows:

- **Engineering items** (Includes equipment, nozzles, instrumentation, inline components, and lines)
- **Non-engineering items** (Includes items that are not counted in reports, including flow arrow, gap, actuators, connectors, annotations, spec breaks, and others)
- **Pipe line group**
- **Signal line group**

You can modify the default value for classes as well as whether the properties are read only or not. These properties are available in the Data Manager.



Property Name	Property Description	Display Name	Default Value	Property Type	Acquisition	Read Only	Visible
*ClassName	System property ...	Class Name	Angle Valve	String	None	☑	☑
*Description		Description	ANGLE VALVE	String	None	☐	☑
*Manufacturer		Manufacturer		String	None	☐	☑
*ModelNumber		Model Number		String	None	☐	☑
*Supplier		Supplier		String	None	☐	☑
*Comment		Comment		String	None	☐	☑
*Size	System property ...	Size	Acquisition	List	Pipe Line Seg...	☐	☑
*Spec	System property ...	Spec	Acquisition	List	Pipe Line Seg...	☐	☑
*Tag	System property ...	Tag		String	None	☐	☑
*ValveCode		Valve Code		String	None	☐	☑
*Normally	System property ...	Normally	NO	Symbol List	None	☐	☑

Tag Formats

Setting up tag formatting

Set up tag formats to help drafters apply tag elements consistently throughout a project cycle. You can set up tag formats for equipment, valves, nozzles, instrumentation, pipe lines, and pipes. You can create new tag formats or modify existing formats.

Tag formats are assigned to a class definition. Typically, parts of the tag are also class definitions (for example, a definition *type*, such as *equipment*). You can also use a property of a drawing or project in the tag numbering format. For example, at the drawing level, you might want to set tag formatting to key off of a sheet. At the project level, you could set tag formatting to key off of the project number.

Tag formats are used to structure specific information for a component or line into a tag. The information is stored in the tag as a property of a component or line, and can be displayed in an annotation callout when a component or line is annotated. The block used for the annotation style determines what information is displayed in the callout.

Set Up Tag Formatting for a Class

Tag formats are for the class definition project-wide. Most of the default tag formats tag items at the *class*

definition level (for example, a class definition *type*, such as *equipment*). You can use the property of the class, of a drawing, or of the project in the tag numbering format. At the drawing level, you might want to set tag formatting to key off of a sheet. At the project level, you could set tag formatting to key off of the project number.

Set Up Tag Formatting Using Acquiring Properties

Tag formats can include properties that acquire their values from other properties. For example, if a line acquires its Unit value from a project-level property, you can use that acquiring property in the line's tag format. If the Unit value at the project level were to change, all tags with that property as a subpart would update to reflect that change.

Set Up Tag Formatting for a Pipe Line Group

Pipes are the only components that are automatically grouped. Although Pipe Line Groups are constructs rather than physical entities, you set up tag formatting for Pipe Line Groups just as you would for any other component.

The default tag format is Line Number, and you can add other properties as needed, for example *Service*.

Understand Default Tag Formatting Templates

AutoCAD P&ID provides the following tag format templates for you to use or modify to fit with your company tag formatting standards:

- Equipment tag (Type-Number). Defined by default with a type property and a number (for example: P-100).
- Equipment tag 2 (Area-Type-Number). Defined by default with an area property, type property, and number (for example: 25-P-1000).
- Hand valve tag (Code-Number). Defined by default with two letters representing a valve code and a number (for example: HV-100).
- Nozzle tag (N-Number). Defined by default with one or more letters representing a nozzle code and a number (for example: N-1).
- Instrumentation tag (Area-Type-Number). Defined by default with an area, type, and loop number (for example: 51-PT-100).
- Line number tag. Defined by default with a line number (for example: 100).
- Pipeline tag (Size-Spec-Service-Line Number). Defined by default with size value, spec, service, and line number (for example: 6"-C1-P-10014).

Build Tag Formatting Expressions

You can define how tag elements are expressed. For example, you can create an instrument tag of Area-Type-Loop Number_Suffix (25-FE-1002_A). As you define the formatting for a tag, you can control the formatting of the values that can be assigned when tagging a component or line through expressions.

Using expressions, you can designate whether a value must be entered as text characters, numbers, or any combination of text characters and numbers (free-style value). When you enter a value while assigning a tag, you can also define an expression to generate a value automatically when a drafter adds a component to a drawing. You can set automatic expressions to a drawing or project property.

Understand Tag Uniqueness

The entire tag property must be unique. Even items of different types must have unique tags. For example, if you assign the tag A-123 to a pump, you cannot assign the identical tag to a tank.

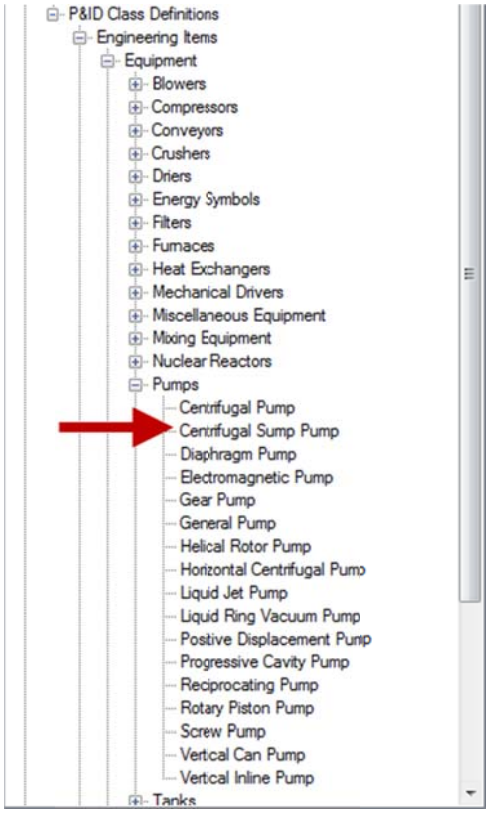
Line segments tags are an exception to this rule and can be identical. The tag properties of a line group must be unique, but the tag properties of the line segments within that line group can be the same.

Another exception to this rule allows you to tag a large component that stretches across drawings with duplicate tags. Duplicate tags can represent different parts of the same item. For example, a line that spans drawings using an Off Page Connector can have the same tag in each drawing. The Data Manager has a single row for components that span two drawings.

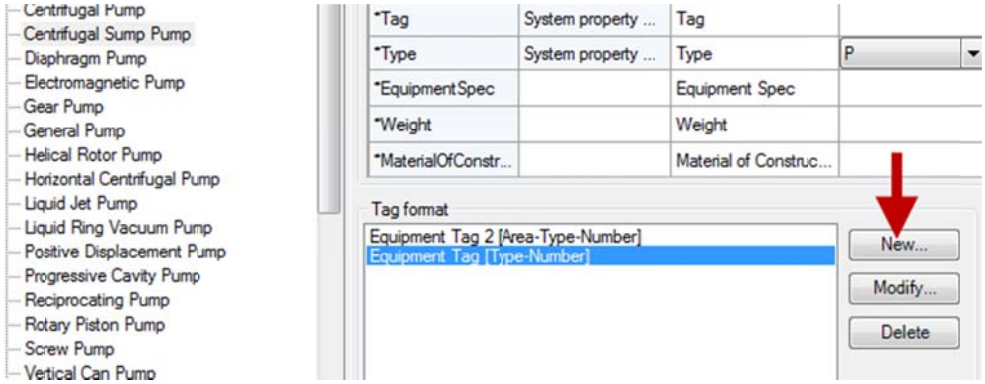
In this exercise, you set up the tag formatting for the new pump to be *Type-Area-Number*.

To create a new tag format from an existing tag format

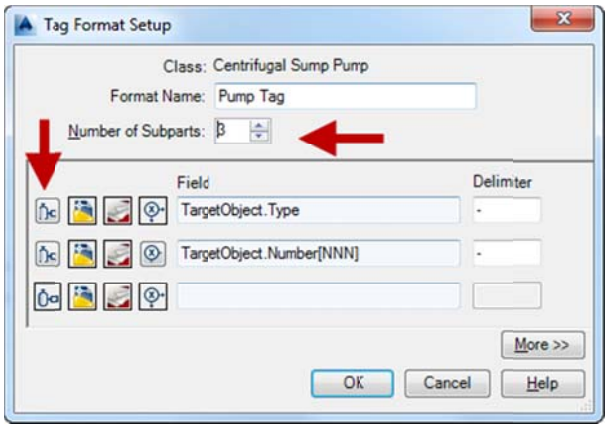
Navigate to the Centrifugal Sump Pump Class.



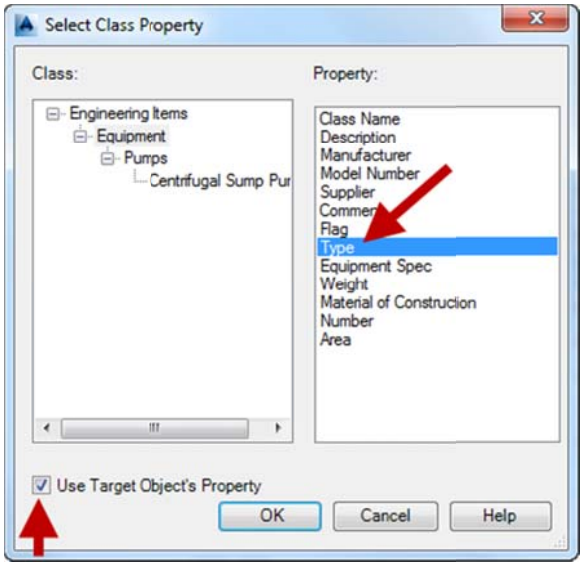
On the P&ID Class Definition Settings pane, under Tag Format, select Equipment Tag [Type-Number], and then click New.



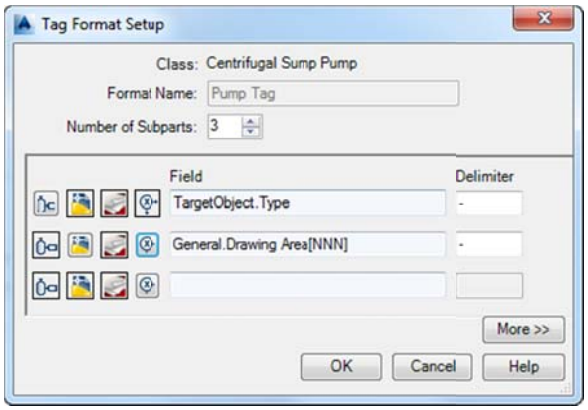
In the Tag Format Setup dialog box, to the right of Format Name, enter **Pump Tag**. To the right of Number of Subparts, click the Up arrow once so that the number 3 is displayed.



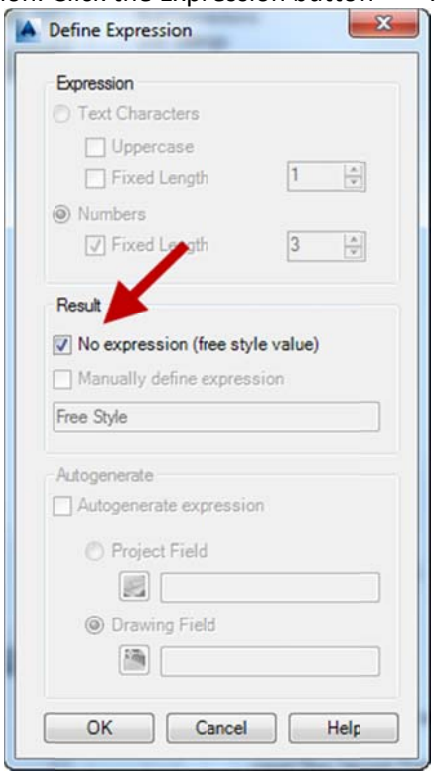
You are building a new tag format from the existing Equipment tag format. Click the Pump Icon on the first row, which launches the Class property selection window. With use Target Object's Property checked, select Equipment on the left, and then select Type.



In the Tag Format Setup dialog box, in the second row, click Select Drawing Property icon  . Select the Area property.

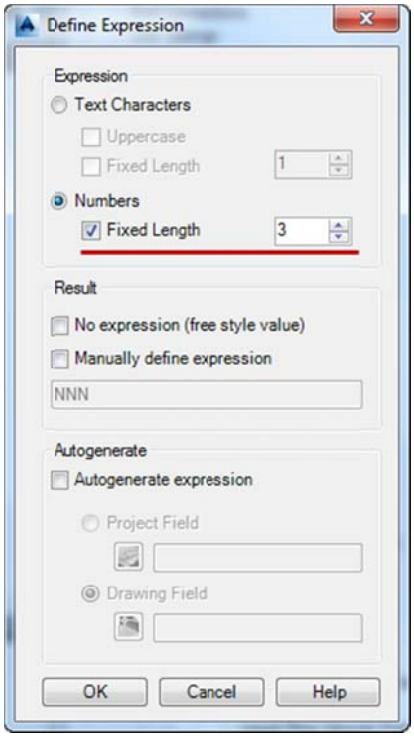


Because we want to allow the user to input any value for the Area property, we need to modify the expression. Click the Expression button  .

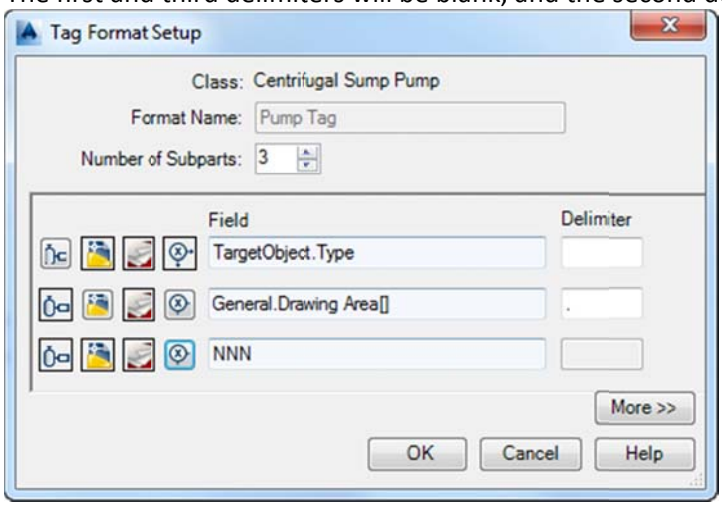


In the Tag Format dialog box, third row, click Define Expression.

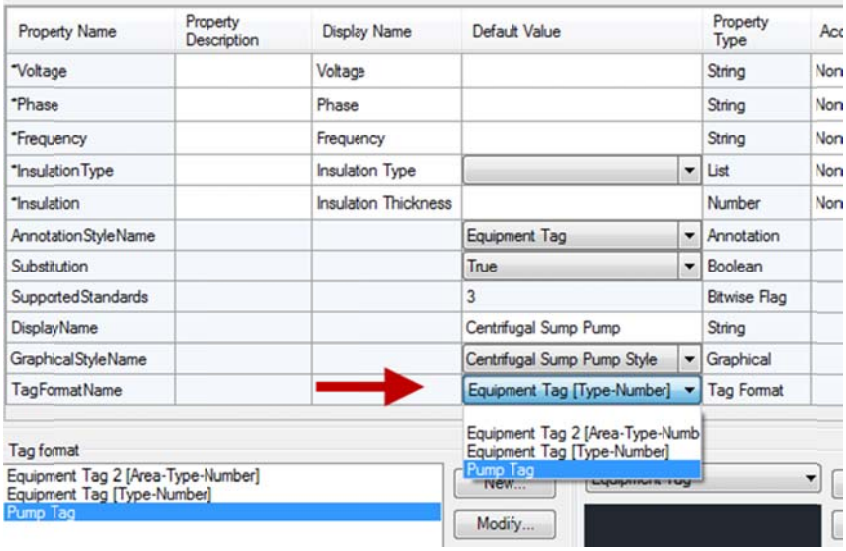
In the Define Expression dialog box, under Expression, select Numbers. To the left of Fixed Length, click the box to add a check mark. In the box to the right of Fixed Length, click the Up arrow twice until the number 3 is displayed.



In the Tag Format Setup dialog box, set the Delimiter fields as follows:
The first and third delimiters will be blank, and the second delimiter has a "." In it.

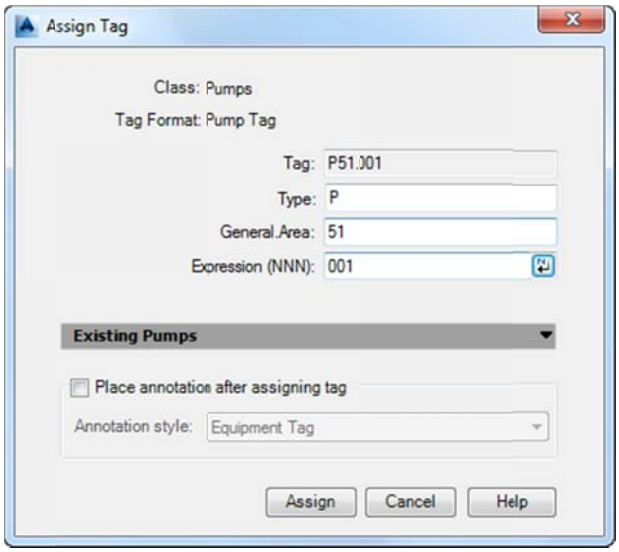


In the properties for the Centrifugal Sump Pump, set the Tag Format Name to Pump Tag, and hit Ok to exit project setup.



In the Project Setup dialog box, click OK to save the changes and close the dialog box.

You have created a new Pump Tag format and assigned it to the centrifugal sump pump. When you use this pump in a drawing, the Assign Tag dialog box prompts you to enter tag data for the three-part tag you created (*TypeArea.Number*).



For more information about assigning tags, see “Tag and Annotate Components and Lines” in chapter 4 of the AutoCAD P&ID 2014 Getting Started Guide.

Annotation

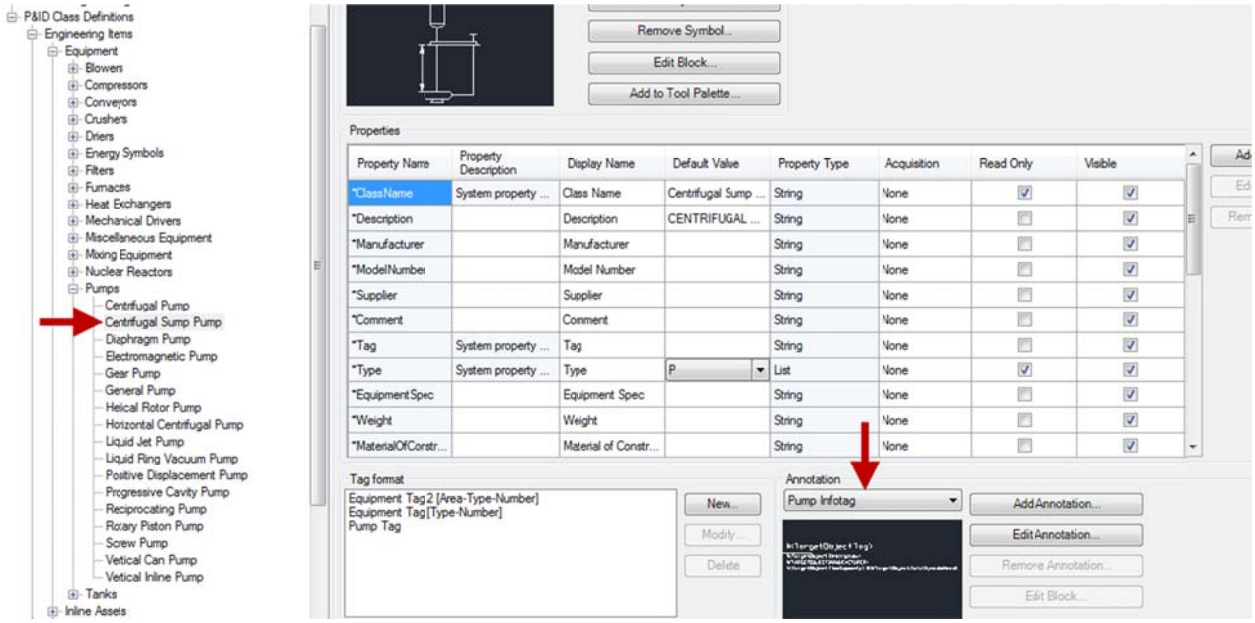
Setting up Annotations

Annotation is used to describe a component or line in a drawing. You can change the following information for annotations:

- **Symbol Properties.** Sets the symbol name and block.
- **General Style Properties.** Sets the layer, color, linetype, linetype scale, plot style, and lineweight for the annotation.
- **Other Properties.** Sets whether the annotation inherits the component's properties, whether the annotation is linked to an object, whether the annotation is automatically inserted, the X and Y offset to a component, and whether a spec break, when placed on a schematic line, indicates a change in line properties.

To create a new annotation style from an existing annotation style

Navigate to the Centrifugal Sump Pump class.

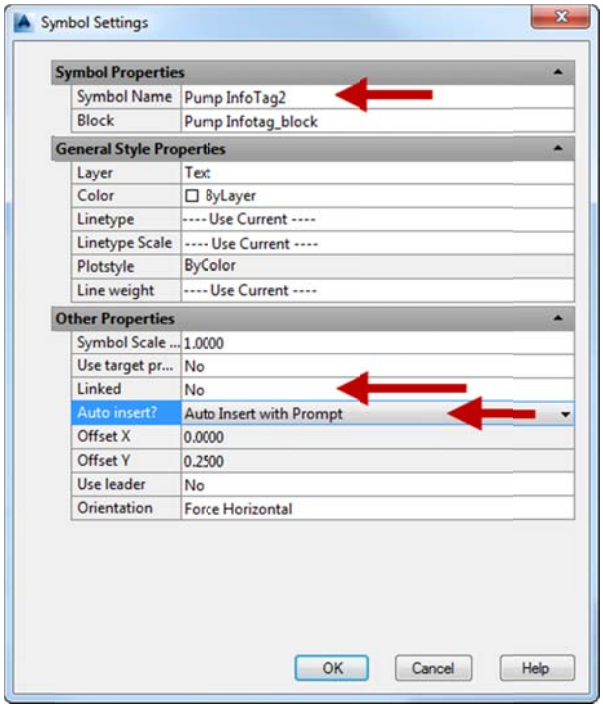


On the P&ID Class Definition Settings pane, under Annotation, in the drop-down list, select Pump InfoTag.

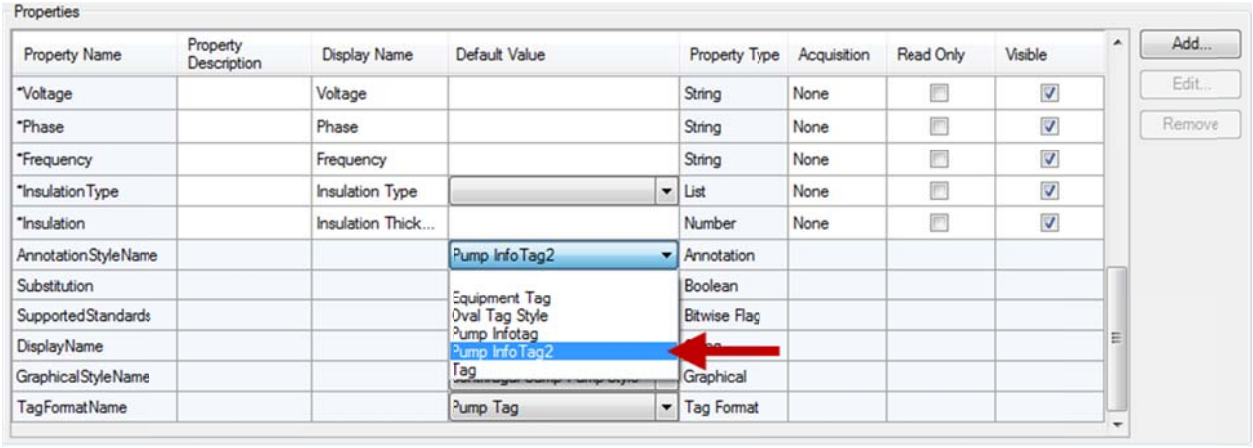
Click Add Annotation.

In the Symbol Settings dialog box, do the following:

- Under Symbol Properties, to the right of Symbol Name, enter **Pump InfoTag2**.
- Under Other Properties, to the right of Linked, in the drop-down list, select No. When you use the annotation in a drawing, the annotation will not move with the pump when the pump is moved.
- Under Other Properties, to the right of Auto Insert, in the drop-down list, select Auto Insert with Prompt. When you use the annotation in a drawing, you will be prompted to annotate the pump.
- Click OK.



In the Class Definition Settings pane, under Properties, locate the Property Name column and select the AnnotationStyleName row. In the Default Value column, to the right of AnnotationStyleName, in the drop-down list, select Pump InfoTag2.



In the Project Setup dialog box, click OK. Place a new Centrifugal Sump Pump in the drawing.

Based on the way you set up the annotation's insertion behavior, you are prompted to specify the annotation position.

Click in the drawing to place the annotation. If the Assign Tag dialog box is displayed, click Cancel. Move the pump in the drawing. Notice that based on the way you set up the annotation linking, the annotation does not move with the pump.

Creating New Annotations

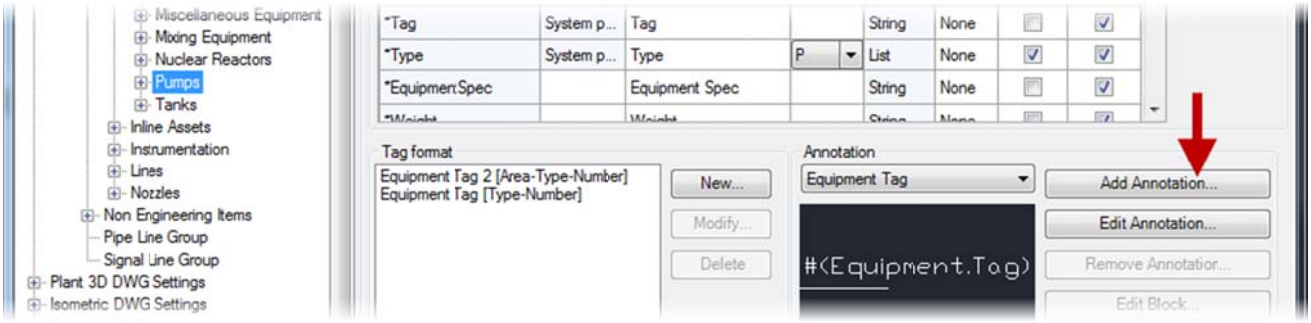
P&ID has “starter” annotation templates to make it easier for you to get going. These annotation blocks are in the file AnnotationTemplates.DWG installed in the program file folder. They mostly have text that says “unassigned”. When you are setting up an annotation, you start with one of these, and then fix the “unassigned” text to reference the field you really want.

Let’s make a more informative info tag. This infotag will be for pumps and will say:

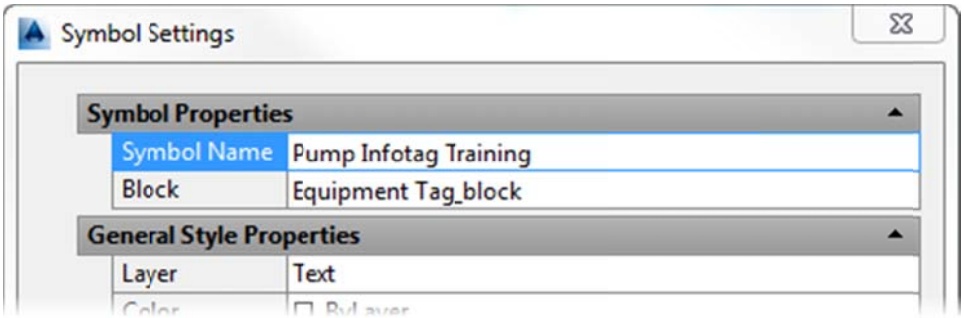
TAG NUMBE***R***
Description CAPACITY: *Flow @ tdh* TDH POWER REQ’T: *Power* MATL: *Material* INSULATION: *Insulation*

Make a new Annotation

In the Project Setup dialog, navigate to Pumps. Under Annotation in the right pane, click on Add Annotation.

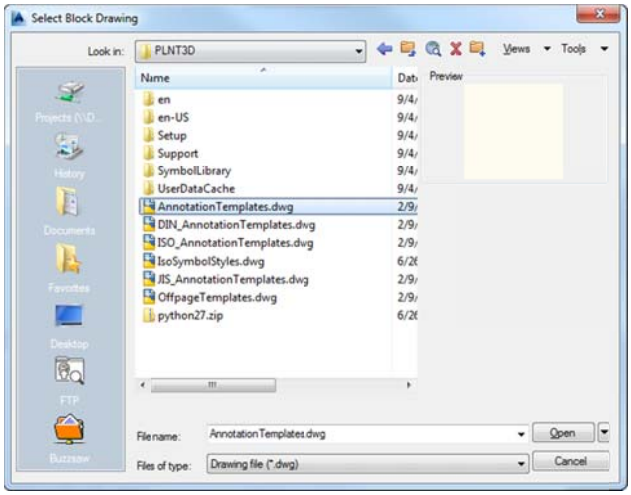


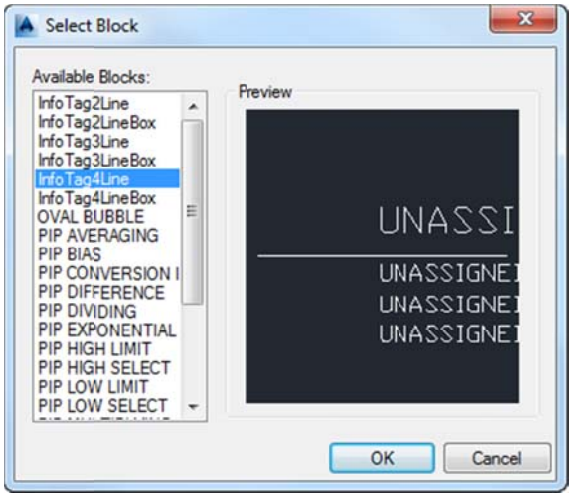
Give the symbol a new name (like, Pump Infotag Training), in Symbol Name.



Select the Block field and click on […].

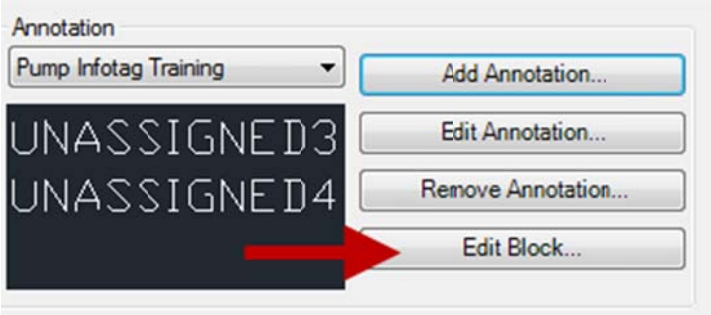
Navigate to C:\Program Files\Autodesk\AutoCAD 2015\PLNT3D\AnnotationTemplates.dwg and click Open.

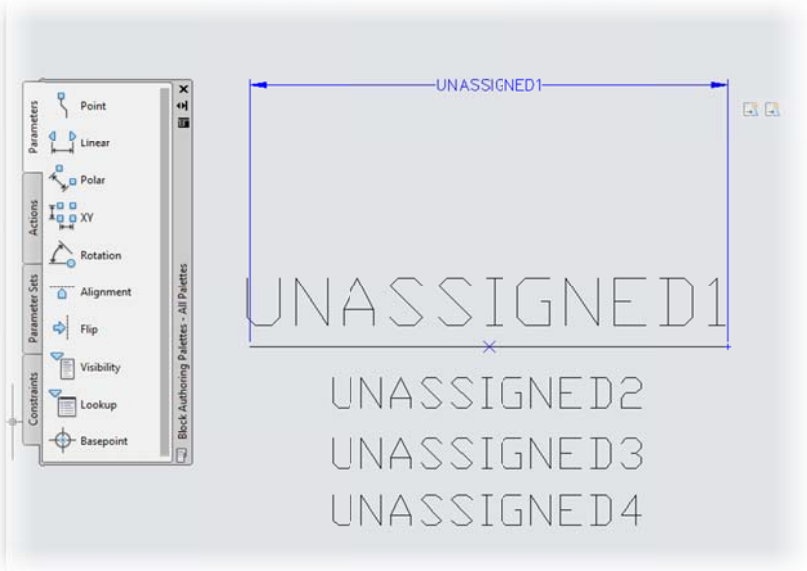




Select the InfoTag4Line block and click ok.

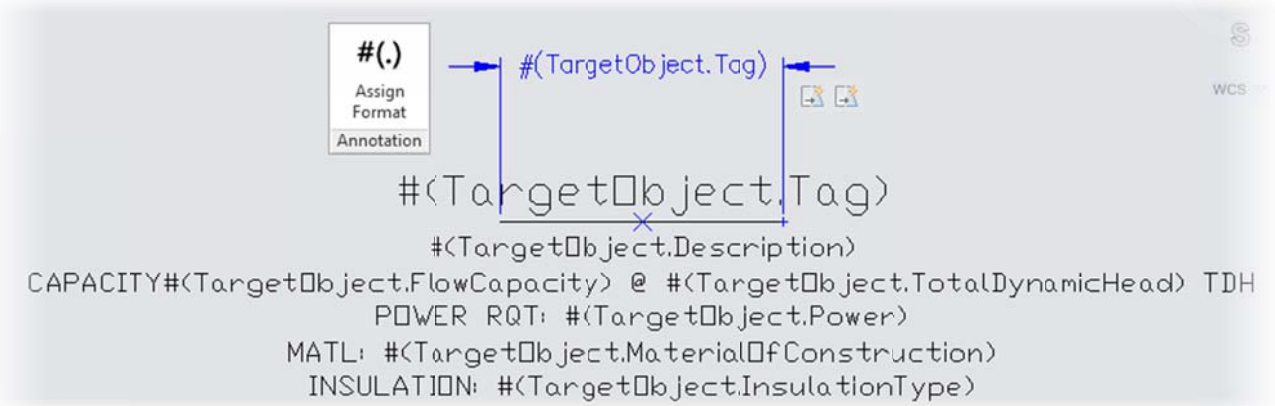
Click Edit Block.



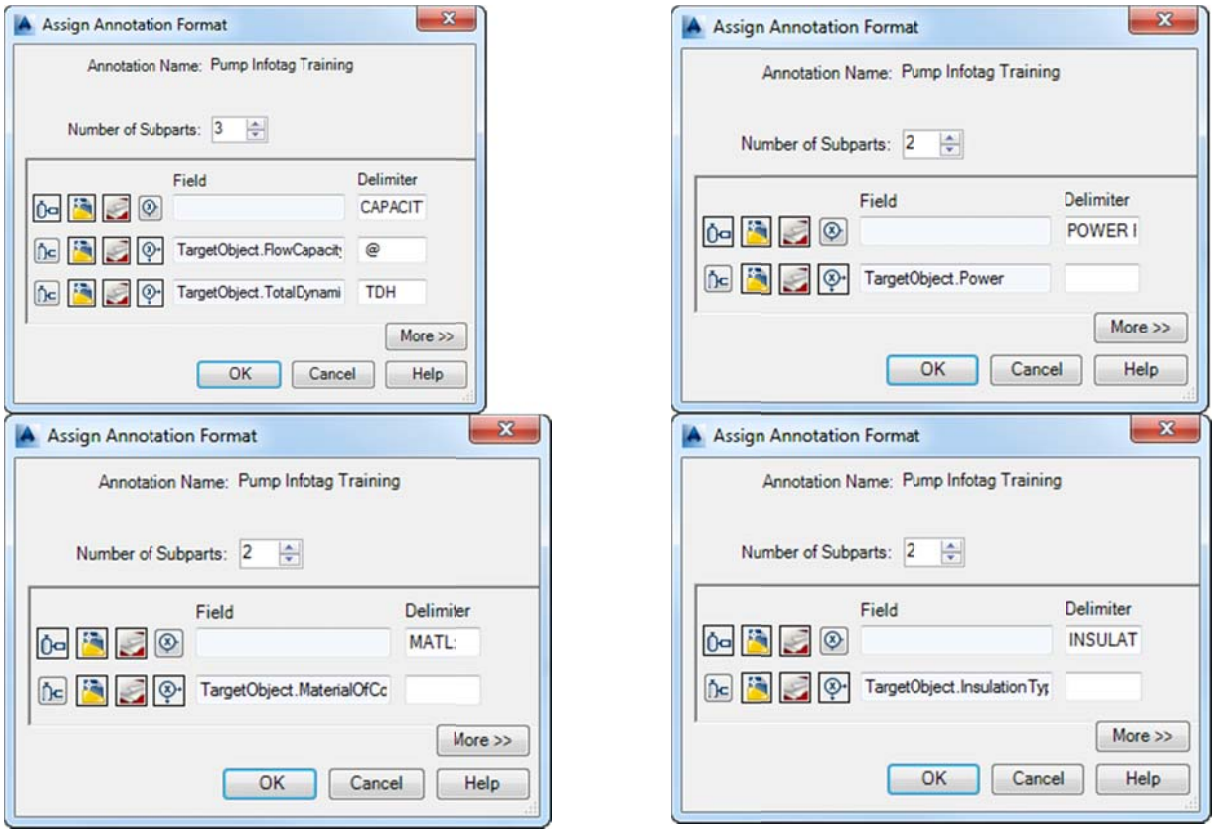


Use copy and edit the properties to make lines UNASSIGNED5 & UNASSIGNED6. We're going to use the

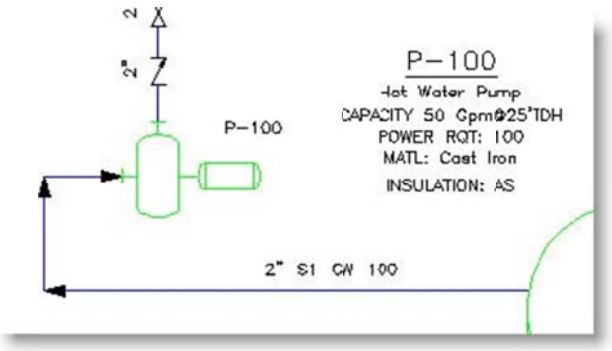
toolbar button to assign values to the rows until it looks like the following diagram.



The format dialogs for the last four items should look something like this.



Close the block editor & save changes to the block. It should be visible from the pumps annotation graphic now. Test it.



***NOTE**: Some annotations are extra peculiar. These include*

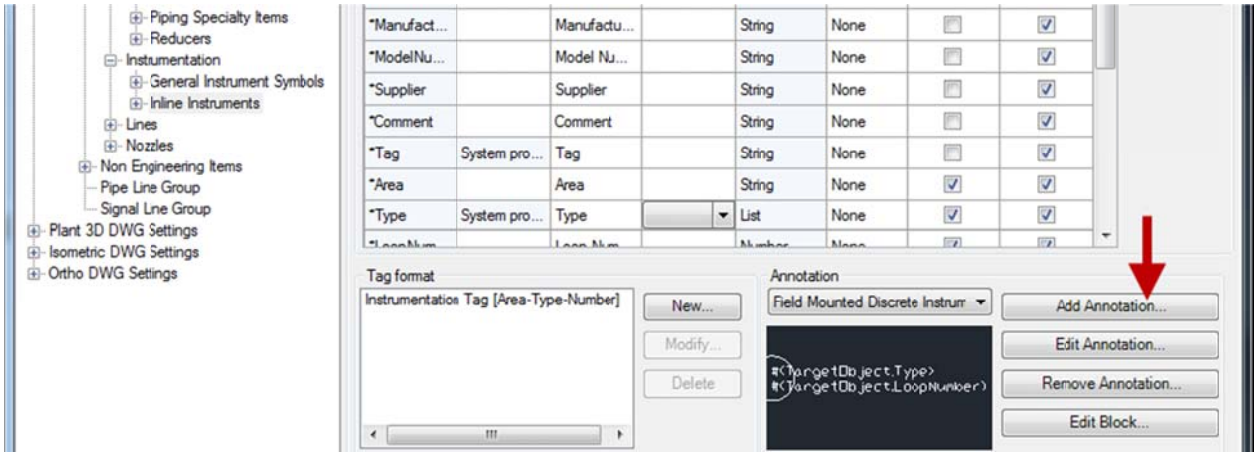
- *Off Page Connectors*
- *Spec Breaks and other segment breakers*
- *Drain Symbols*
- *Super-smart annotations like the Reducer-by-size.*
- *Annotations with smart wipeout frames or underline behaviors. How to set these up is captured in the help or in various white papers.*

Instrument Bubbles

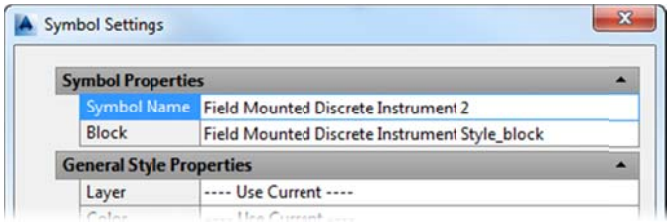
We will next look closer at instrument bubbles – we will create a different instrument bubble with AREA and TYPE at the upper part of the bubble, and LOOPNUMBER in the lower part of the bubble.

The instrument bubble block looks like this: You typically won't need to create an instrument block from scratch and can instead use the one shipped with the software. If you want to rework the instrument bubble, it is recommended that you start with one of the shipping instrument styles. Below is an example of how to rework the bubble to have AREA-TYPE over Loop Number. As you can see in the above diagram, the loop number is already referenced in the lower text field, so we will concentrate on the upper text field.

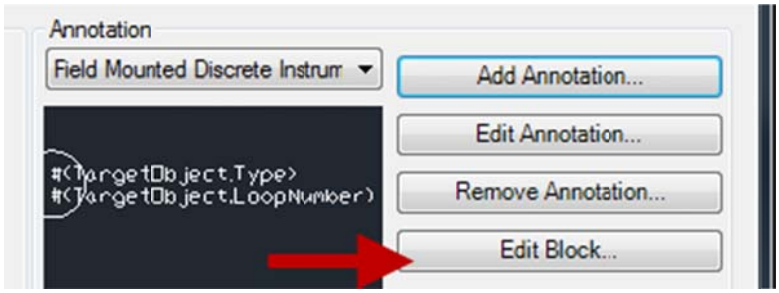
Inside the Project Setup dialog, browse to the Inline Instruments class and select it. On the right, click Add Annotation.



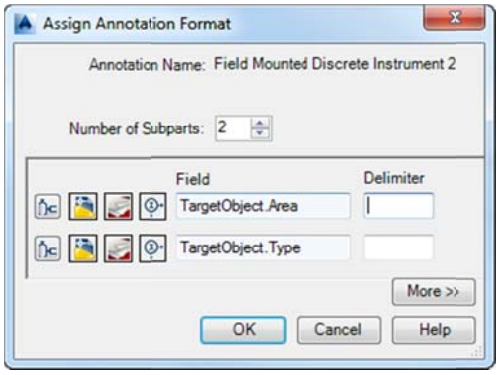
Name the annotation Field Mounted Discrete Instrument 2 and click Ok.

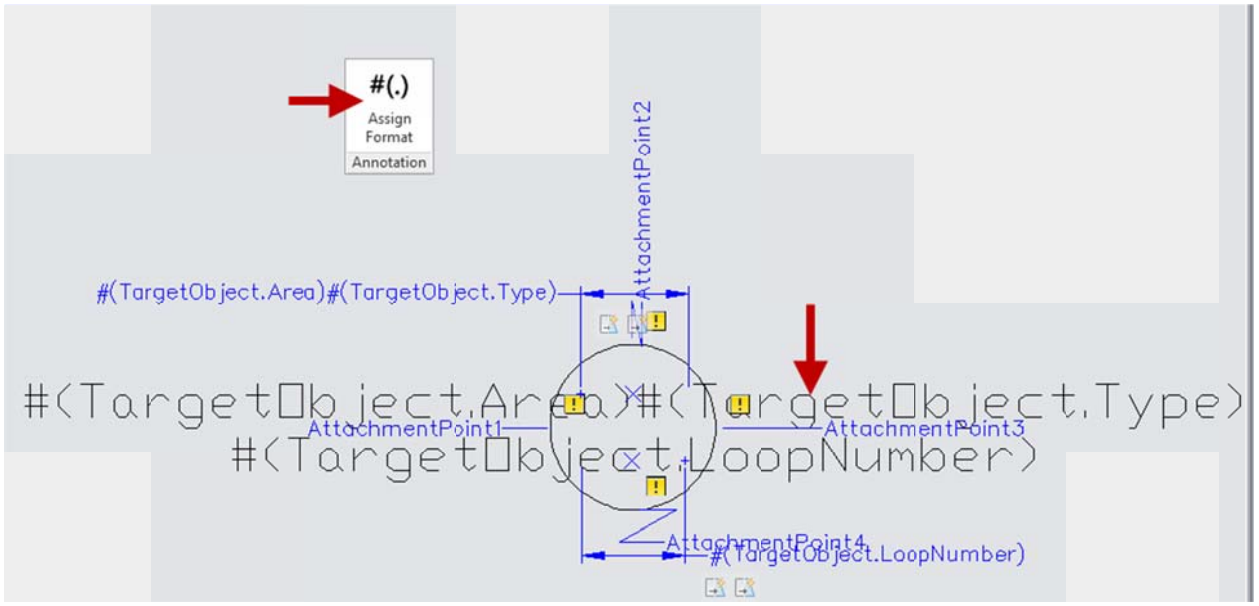


Click edit block.

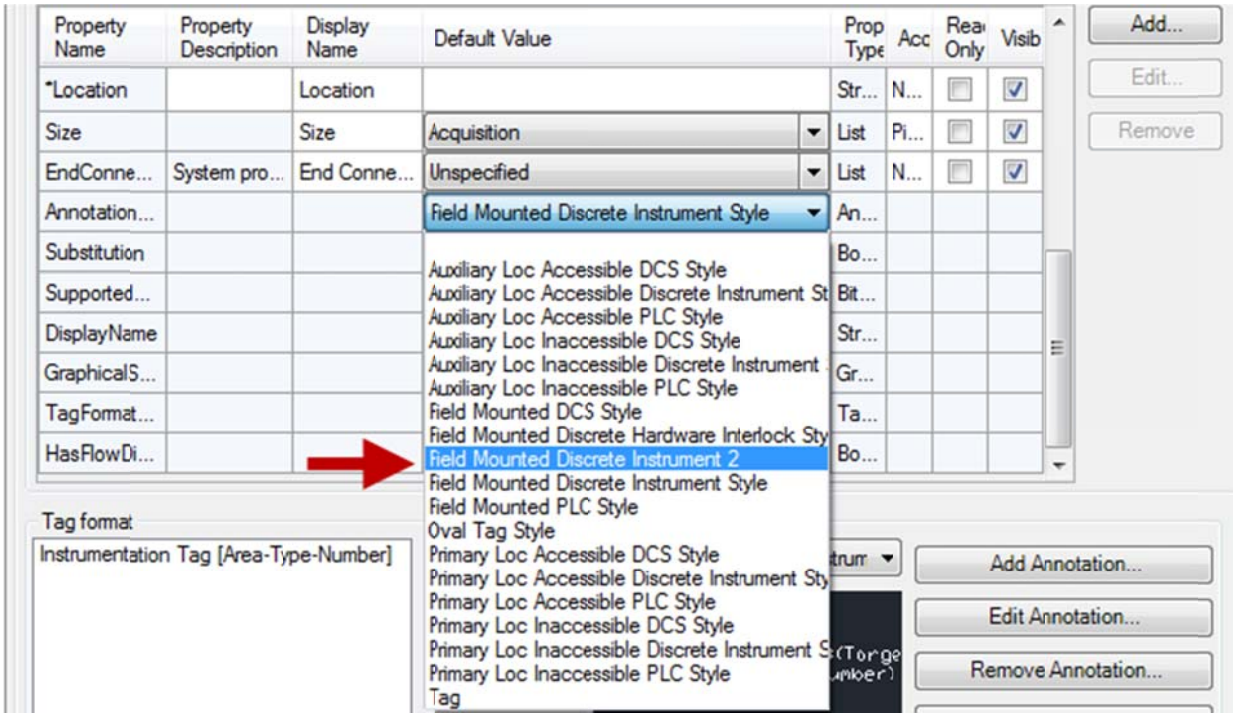


Use the assign annotation button to make the top attribute have a combined Area and Type value.



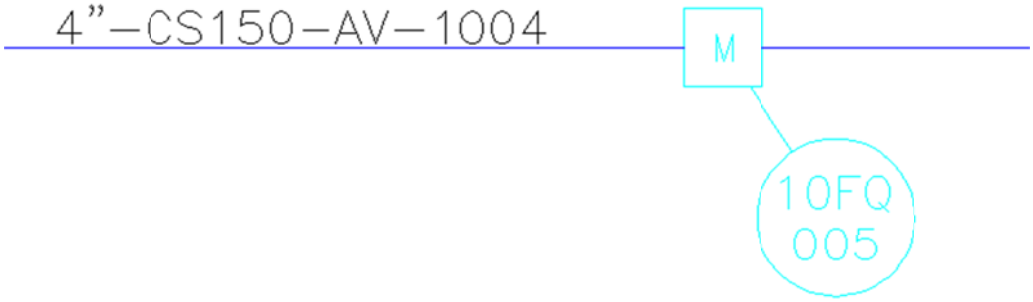


Close the block editor & save changes to the block.
In Project Setup, in the Properties window, scroll down to Annotation Style Name and click the dropdown under Default Value. Change the default to New Field Mounted Discrete Instrument Style.



Click OK.

Test this new instrument bubble by placing a Magnetic inline instrument and notice how the area is included in the bubble.

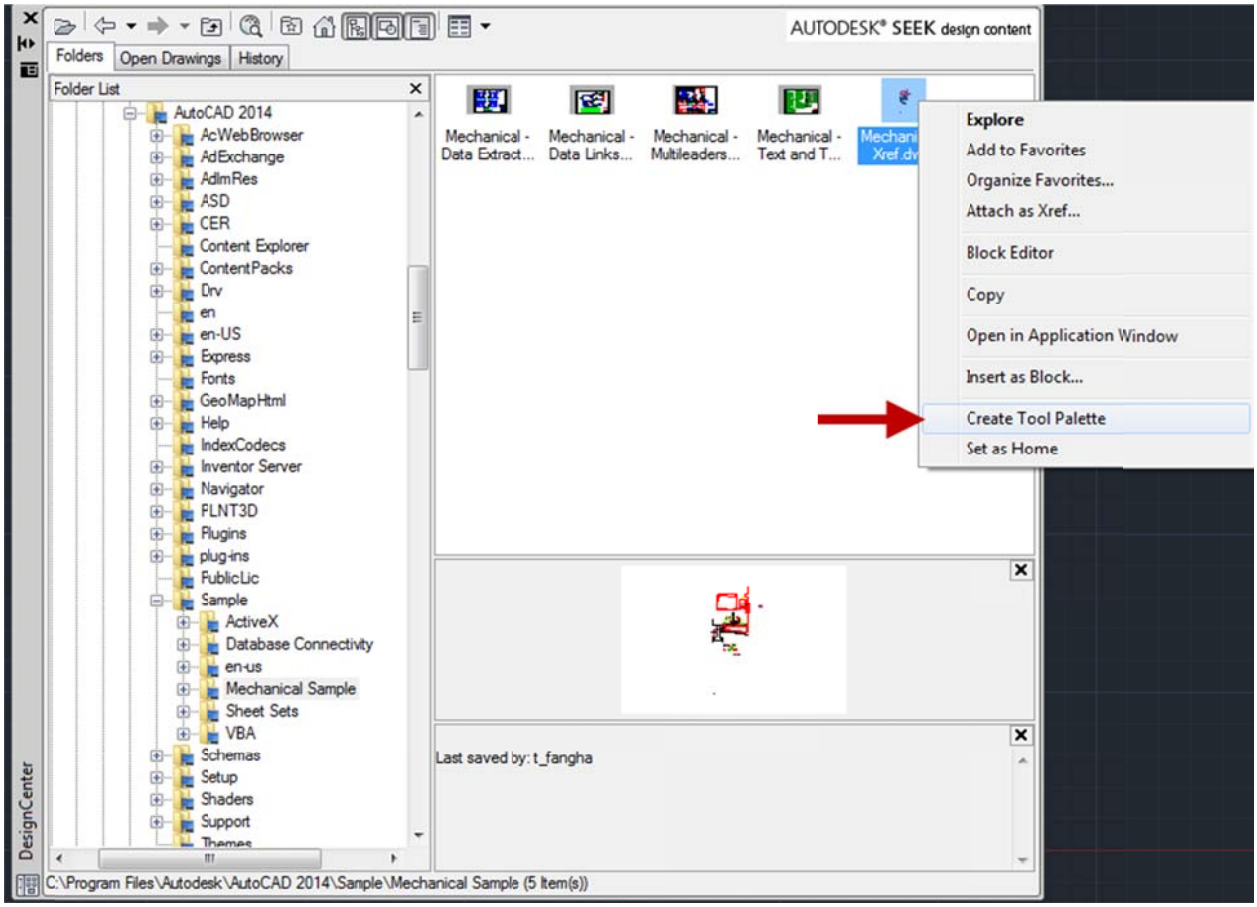


Tool Palettes

You can add tools to a tool palette with several methods.

You can create new tool palettes using the Properties button on the title bar of the Tool Palettes window. Add tools to a tool palette with the following methods:

- Drag any of the following onto your tool palette: geometric objects such as lines, circles, and polylines; dimensions; hatches; gradient fills; blocks; xrefs; raster images.
- Drag drawings, blocks, and hatches from DesignCenter to the tool palette. Drawings that are added to a tool palette are inserted as blocks when dragged into the drawing.
- Use the Customize dialog box to drag commands to a tool palette just as you might add them to a toolbar.
- Use the Customize User Interface (CUI) editor to drag commands to a tool palette from the Command List pane.
- Use Cut, Copy, and Paste to move or copy tools from one tool palette to another.
- Manage tool palettes by creating new palettes from scratch, renaming, deleting or moving palettes with the shortcut menu.
- **NOTE** It is not recommended to create or rename tool palettes when the Customize User Interface (CUI) editor is displayed.
- Create a tool palette tab with predetermined content by right-clicking a folder, a drawing file, or a block in the DesignCenter tree view, and then clicking Create Tool Palette on the shortcut menu.



NOTE If the source drawing file for a block, xref, or raster image tool is moved to a different folder, you must modify the tool that references it by right-clicking the tool and, in the Tool Properties dialog box, specifying

the new source file folder.

Rearranging Tools and Tool Palettes

Once tools are placed on a tool palette, you can rearrange them by dragging them around or by sorting them. You can also add text and separator lines to tool palettes.

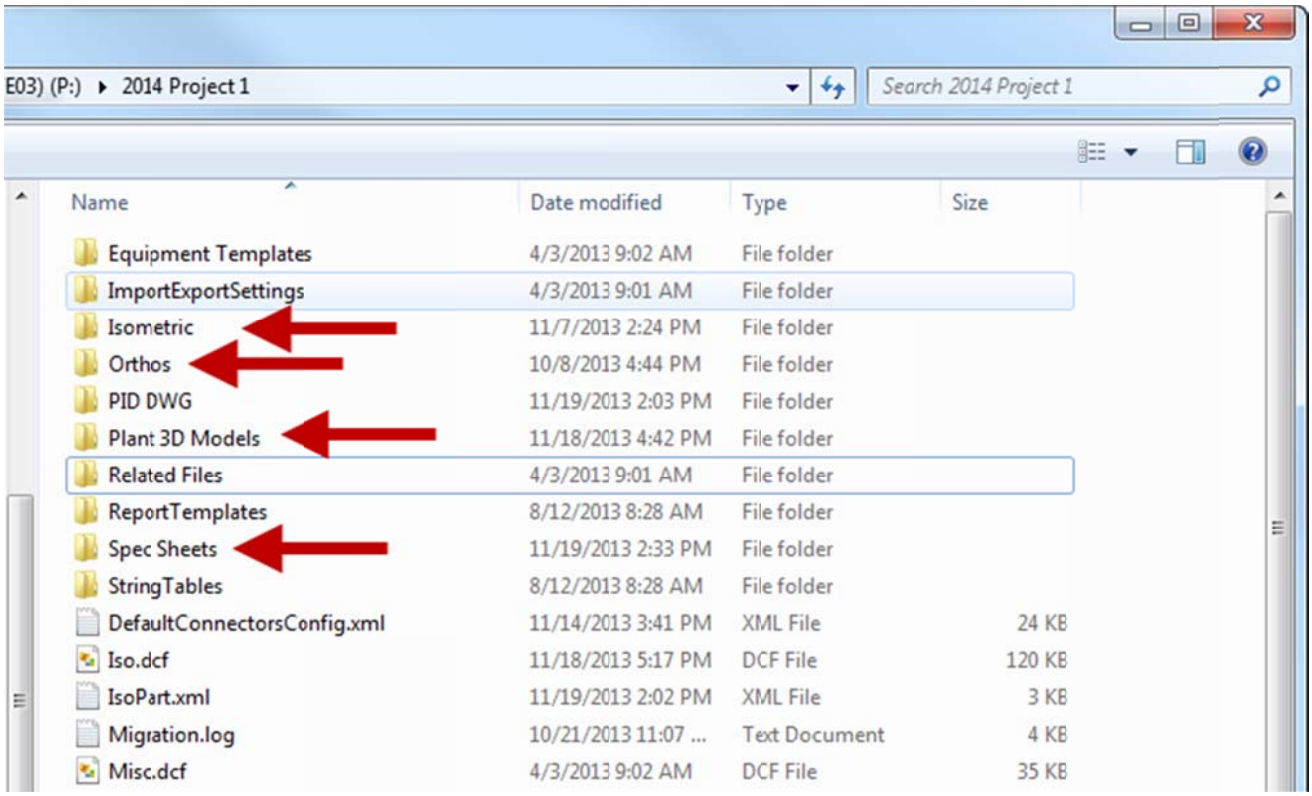
You can move a tool palette tab up and down the list of tabs by using the tool palette shortcut menu or the Tool Palettes tab of the Customize dialog box. Similarly, you can delete tool palettes that you no longer need. Tool palettes that are deleted are lost unless they are first saved by exporting them to a file. You can control the path to your tool palettes on the Files tab in the Options dialog box. This path can be to a shared network location.

Sharing project drawings

Because AutoCAD P&ID stores the data within each drawing file, as well as the database, you have two options for sharing the drawings.

To share individual files, simply send the drawing. You can zip multiple drawings together, but they won't retain all of the connection information without the project.

To share a project or several connected drawings within a project, make a copy of the project folder. Remove extra content like isometric folders, piping specs, and/or drawings that you do not need to send.



Create a zip file of the copied project folder and send that zip.

Chapter 6: Printing Project drawings

Plotting

Plotter Manager

The Plotter Manager is a window that lists plotter configuration (PC3) files for every non-system printer that you install. Plotter configuration files can also be created for Windows® system printers if you want to use default properties different from those used by Windows. Plotter configuration settings specify port information, raster and vector graphics quality, paper sizes, and custom properties that depend on the plotter type.

The Plotter Manager contains the Add-a-Plotter wizard, which is the primary tool for creating plotter configurations. The Add-a-Plotter wizard prompts you for information about the plotter you want to set up.

Layouts

A layout represents a plotted page. You can create as many layouts as you need. Each layout is saved on its own layout tab and can be associated with a different page setup.

Elements that appear only on a plotted page, such as title blocks and notes, are drawn in paper space in a layout. The objects in the drawing are created in model space on the Model tab. To view these objects in the layout, you create layout viewports.

Page Setups

When you create a layout, you specify a plotter and settings such as page size and plot orientation. These settings are saved in a page setup. You can control these settings for layouts and for the Model tab using the Page Setup Manager. You can name and save page setups for use with other layouts.

If you don't specify all the settings in the Page Setup dialog box when you create a layout, you can set up the page just before you plot. Or you can override a page setup at plot time. You can use the new page setup temporarily for the current plot, or you can save the new page setup.

Plot Styles

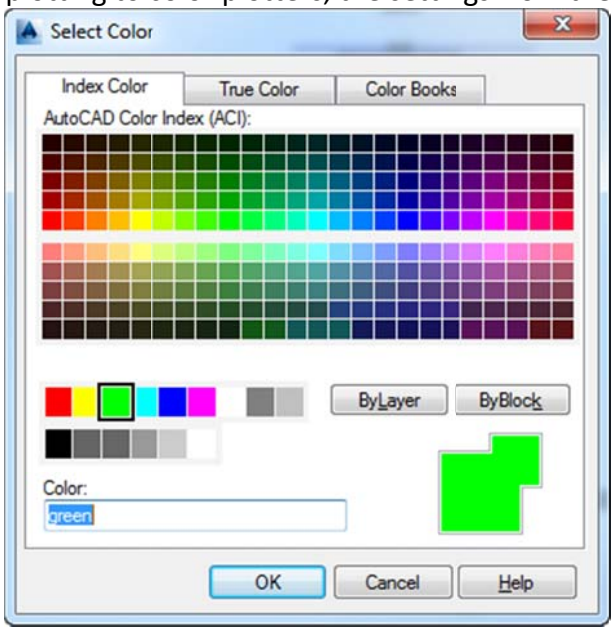
A plot style controls how an object or layer is plotted by determining plotted properties such as lineweight, color, and fill style. Plot style tables collect groups of plot styles. The Plot Style Manager is a window that shows all the plot style tables available.

There are two plot style types: color-dependent and named. A drawing can use only one type of plot style table. You can convert a plot style table from one type to the other. You can also change the type of plot style table a drawing uses once it has been set.

For *color-dependent plot style tables,* an object's color determines how it is plotted. These plot style table

files have *.ctb* extensions. You cannot assign color-dependent plot styles directly to objects. Instead, to control how an object is plotted, you change its color. For example, all objects assigned the color red in a drawing are plotted the same way.

If you choose to use ctb files, you should only use index colors in your drawings. Otherwise, when plotting to color plotters, the settings from the ctb will not get picked up.



Named plot style tables use plot styles that are assigned directly to objects and layers. These plot style table files have *.stb* extensions. Using them enables each object in a drawing to be plotted differently, independent of its color.

Plot Stamps

A plot stamp is a line of text that is added to your plot. You can specify where this text is located on the plot in the Plot Stamp dialog box. Turn this option on to add specified plot stamp information—including drawing name, layout name, date and time, and so on—to a drawing that is plotted to any device. You can choose to record the plot stamp information to a log file instead of plotting it, or in addition to plotting it.

NOTE A drawing file or drawing template file that was created with an educational version will always be plotted with the following plot stamp: PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT. Blocks and xrefs created with an educational version and used in a commercial version will also result in the educational plot stamp being plotted.

Publishing to DWF

A DWF (Design Web Format) is a set of drawings or images that is compressed into a single, smaller file,

making sharing across the Web fast and secure.

Much like Adobe®PDF, the sheets within the set are images of the drawings and are not any more editable than drawings printed to paper. In addition, DWF files retain design information and scale, and are therefore suitable for architects, engineers, and designers to review and mark up, without risk of changes to the original DWG file.

Publishing a P&ID DWF file is very similar to publishing a sheet set in AutoCAD. From the Project manager, you can publish an entire project, a subset of a project, or a single drawing that is part of a project.

To publish a DWF file, use any one of the following methods:

- Click Application menu ➤ Publish.
- In the Project Manager, right-click the project folder. Click Publish Dialog Box.
- At the Command prompt, enter PUBLISH.

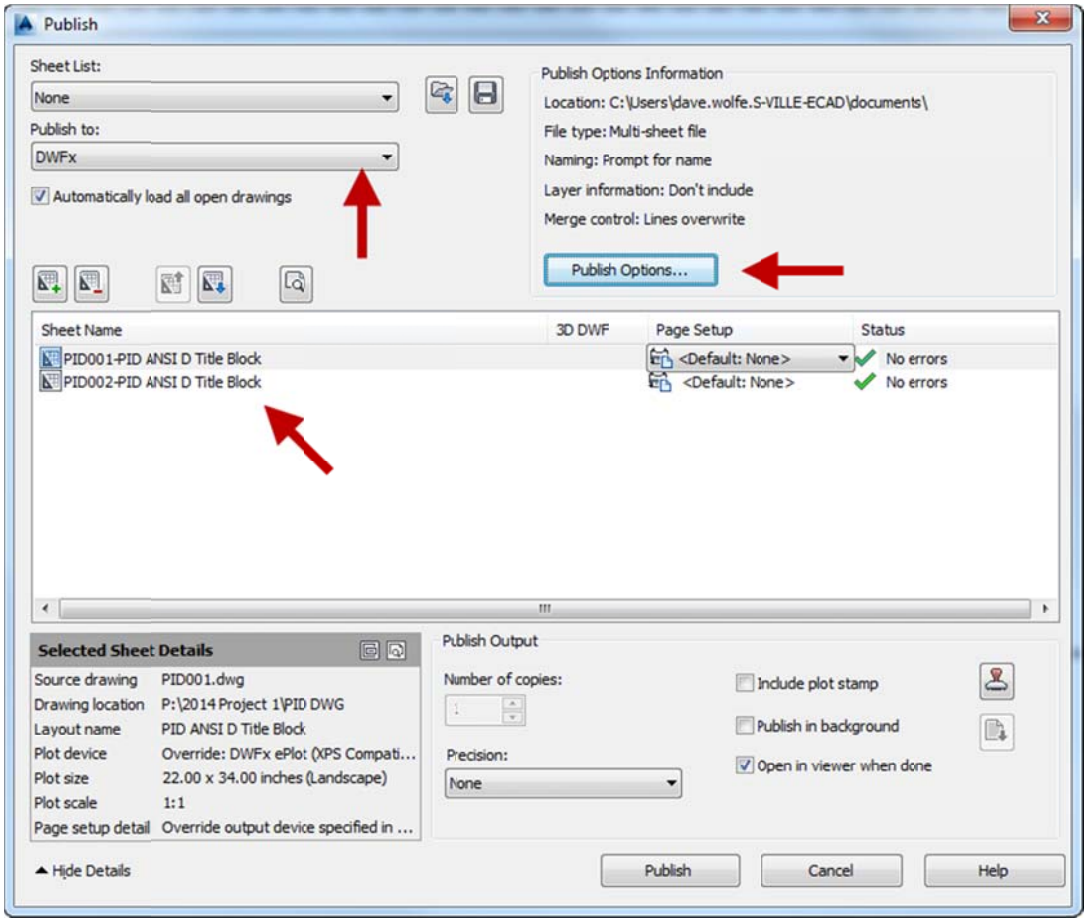
If you plot to a DWF file instead of using the publishing process, you cannot choose P&ID DWF options.

NOTE P&ID information is published only for drawings that are part of the current project. You can add drawings from other projects, but P&ID information is not included for those drawings.

Viewing P&ID DWF files in AutoCAD P&ID

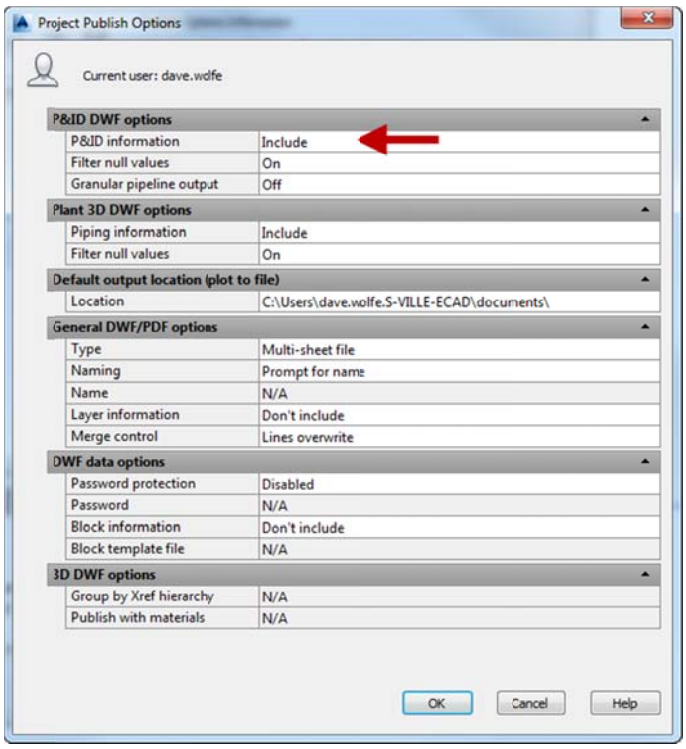
Canvas Pane and Highlight Selection	Segment Lines and components highlight as you move the cursor over them. If you select a line segment, only that line segment is selected and not the entire line group. **NOTE:** Line thickness is not adjustable and is set according to P&ID standards.
P&ID Project/Drawing Information	P&ID-specific data is displayed in the P&ID information category. General information about the entire project and drawing set is displayed in this category. If duplicate property names are found, the property is displayed with extended names. For example, if the property, *Description,* were added to the Project Details and drawing property names and both properties were chosen for DWF inclusion, they would appear in the Properties palette as Description.Project Details and Description.Drawing Properties respectively.
Properties Displayed for Selected Objects	When an object is selected, the Properties palette shows any data you chose to include from the P&ID DWF Output Settings dialog box in AutoCAD P&ID. For example, in the P&ID DWF Output Settings dialog box, you've chosen to include the properties, Description, Supplier, and Tag for a centrifugal pump. When the centrifugal pump is selected in the canvas pane, the Properties palette displays the pertinent P&ID data.
Off-page Connector Hyperlinking	If an off-page connector is connected to an off-page connector on another sheet that is included in the P&ID DWF file, the two off-page connectors are hyperlinked together. For example, the off page connector on the currently viewed sheet shows a property that reads; Origin or Destination: TO T-100. If an off-page connector is connected to an off-page connector on another sheet that is not included in the P&ID DWF file, the connector on the currently viewed sheet is not hyperlinked. Also, if an off-page connector is not connected, it is not hyperlinked.
Publishing Quality	The general quality of P&ID DWF file publishing is improved over DWF files published from the PUBLISH command. Object colors, the thickness of lines, readability of text, and object tags are all published correctly. The background color of P&ID DWF files matches the background color of the source sheet viewed in AutoCAD P&ID. Model spaces with a black background publish with a white background. The background settings for paper spaces are published in white.

The Publish Dialog Box

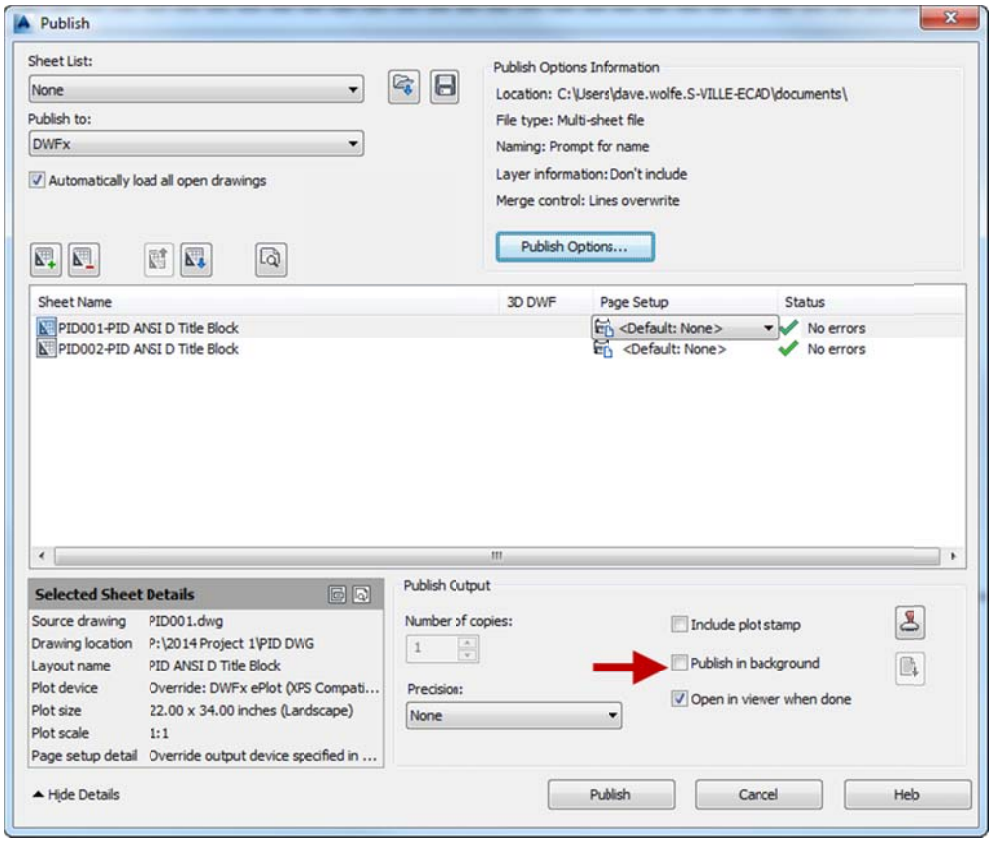


In the publish dialog box above, the DWFx format has been selected (for compatibility with more applications). Also, the layout tabs for P&IDs have been selected.

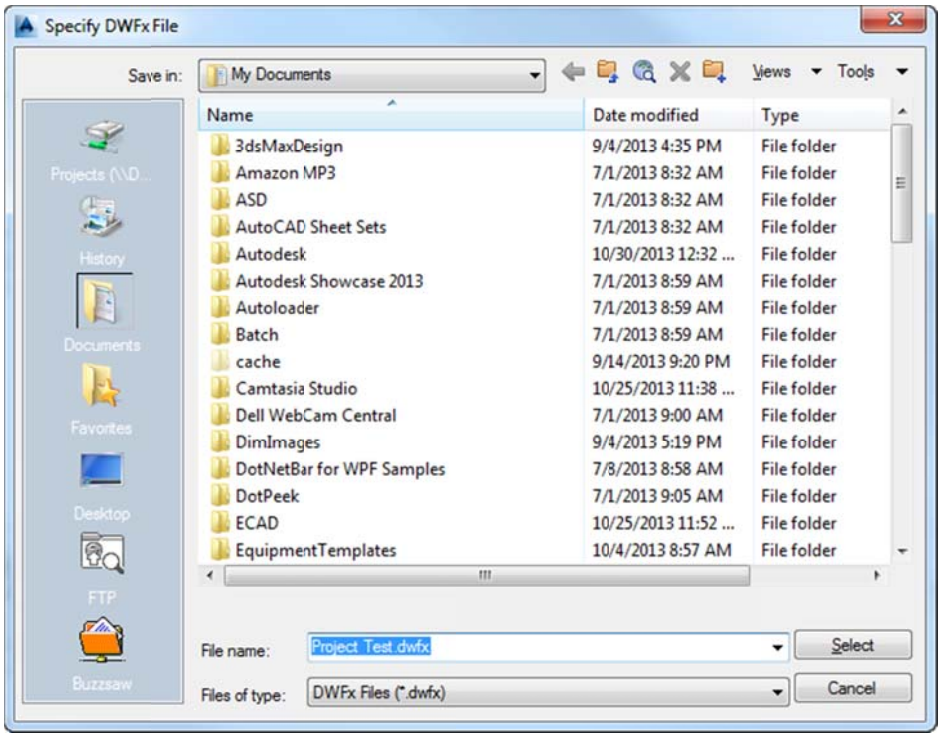
Click Publish Options, and verify the P&ID information should be included before clicking Ok.



Make sure publish in background is unchecked. Publishing goes faster, plots are cleaner, and field properties will be updated when not publishing in the background. Also make sure open in view is checked. Click Publish.



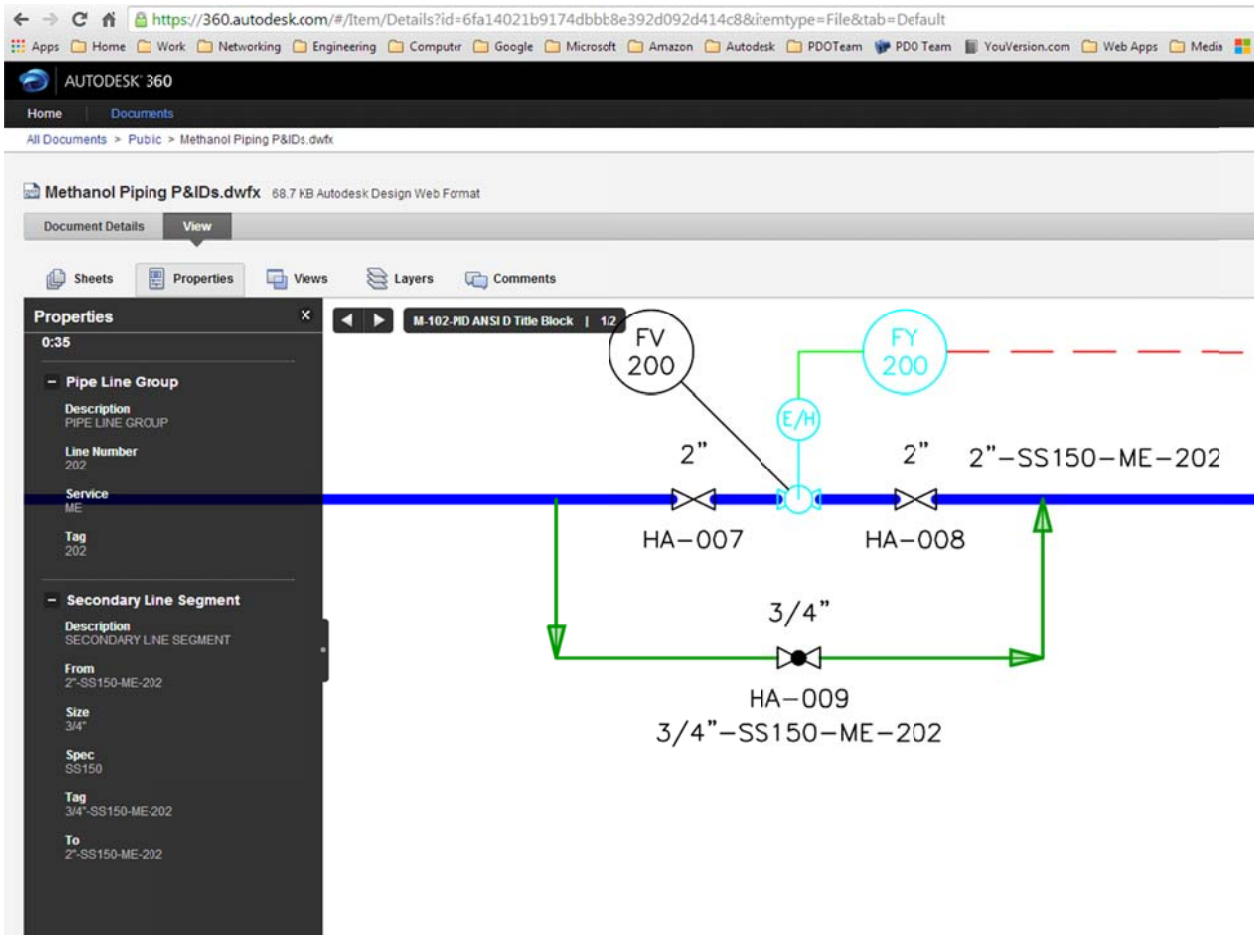
Save the DWFx to a location.



When the DWF file is published, you can use Autodesk Design Review to communicate changes and markups without changing the actual drawing (DWG) file. If you plan to share the DWF file with clients, they should download Autodesk Design Review from the Autodesk website (*www.autodesk.com*).

Online Collaboration

DWFs may also be uploaded to Autodesk 360 for viewing online. Properties in the P&IDs will be available for viewing here as well.



Chapter 7: Audit and Maintain Projects

With auditing tools, administrators can perform periodic project maintenance.

Project Audits

A project audit is initiated with the AUDITPROJECT command which is a variant of the AutoCAD AUDIT command. When an audit is performed on your project, the current project is searched for errors such as links between nonexistent properties in the data cache that no longer point to an object in a source drawing or discrepancies in the tag registry.

A project file must be open and unlocked in order for the auditing process to succeed. Warning messages are displayed if a project is not currently open or if an open project is locked by another designer.

A log file describing problems and the actions taken to resolve them is generated and placed in the project directory containing the data cache, with the file extension *.adt* if the AUDITCTL system variable is set to 1.

Project Compression

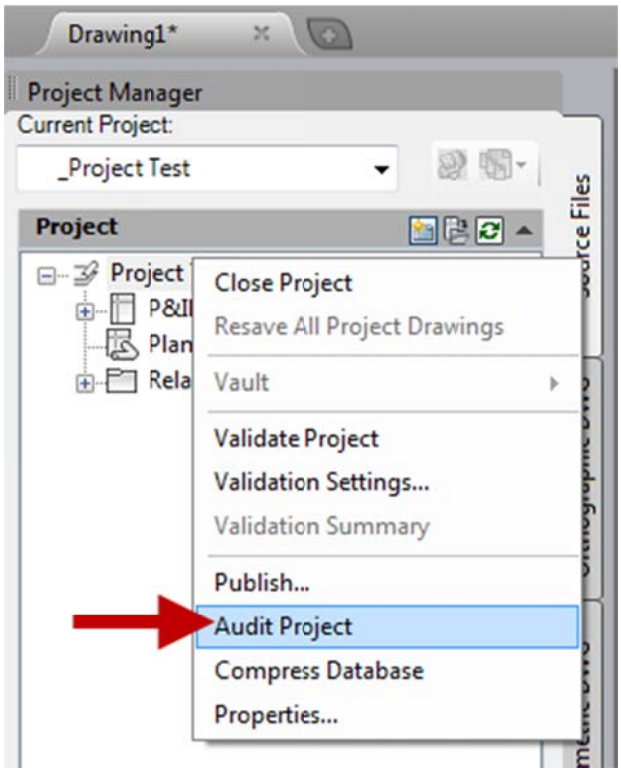
The COMPRESSPROJECT command is used to compress the cache of drawing data that is constantly being updated as work on drawings in a project proceed. As data is added to the cache, fragmentation can occur causing the cache to occupy more disk space than is necessary. Periodic compression of your project will defragment the cache of drawing data, thus optimizing performance and efficiency. Also, the compression process repairs any inconsistencies and prevents corruption of the cache.

The project you want to compress must be unlocked. A project locked by another designer will halt the compression operation.

Procedures: Audit and Maintain Projects

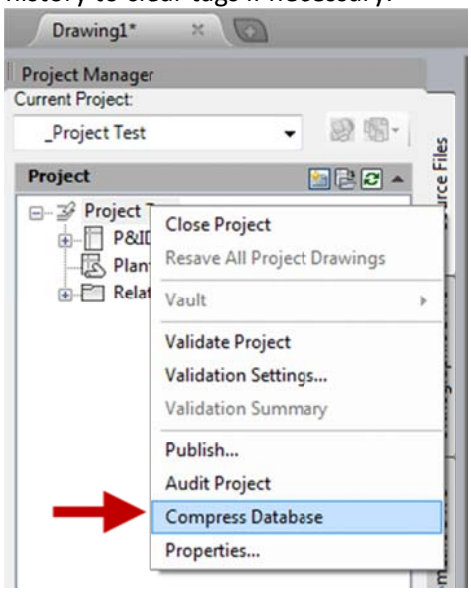
To audit a project

To audit a project, right-click on the project name in the project manager, and select audit project. You can also type in AUDITPROJECT at the command line. Remember, the auditing process **removes** objects that are not tied to the database.



To compress a project

Right-click the project name, and choose Compress database. You may choose remove history to clear tags if necessary.



Chapter 8: Customization

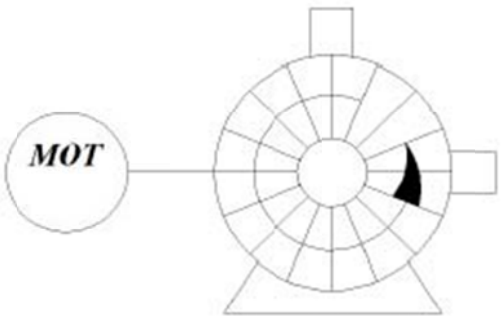
Symbols

Convert AutoCAD Block to P&ID Symbol

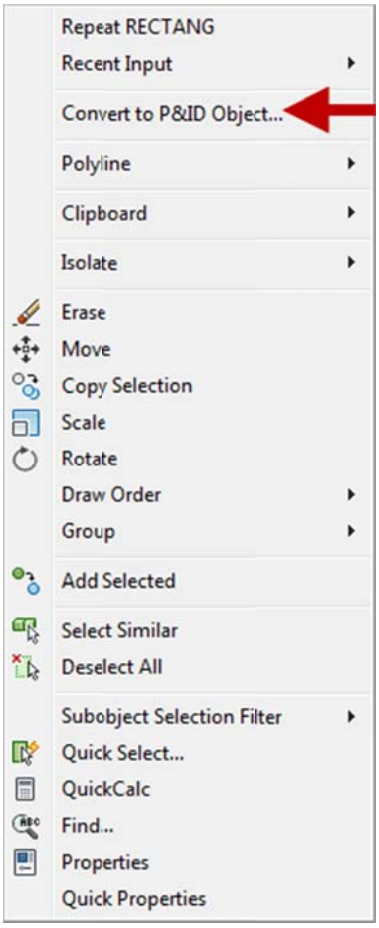
Converting generic AutoCAD geometry into intelligent P&ID geometry is easy to do in AutoCAD P&ID. This can make your life easier if you have been creating P&IDs in base AutoCAD or AutoCAD LT.

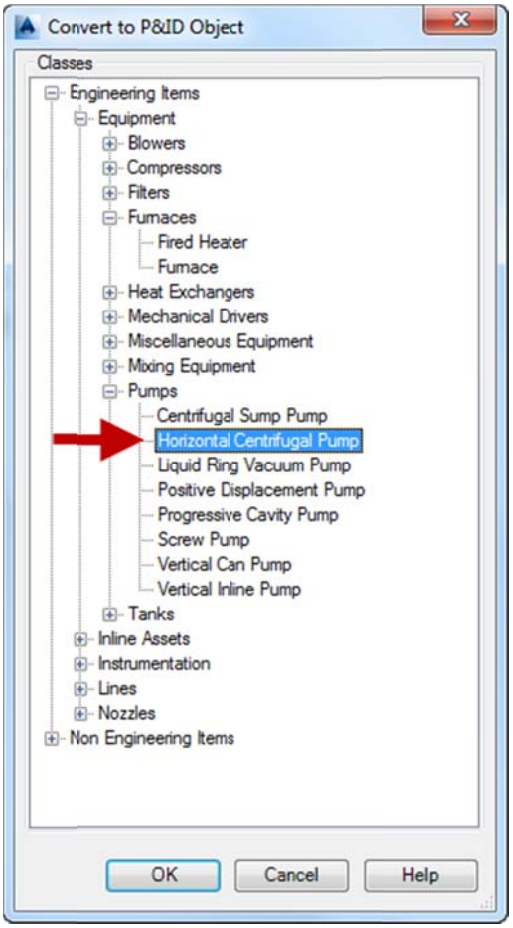
Procedure To Convert an AutoCAD Block to a P&ID Object

To convert AutoCAD symbols we first need a symbol to convert. Create the Centrifugal Pump shown in the next figure and save it as a block.



When the block is done, right-click on it and select Convert to P&ID Object.





This is necessary to add intelligence to the symbol. This symbol can be classified as an Engineering Item, Equipment, Pumps and finally Horizontal Centrifugal Pump as shown in the following figure.

After you convert the block to a P&ID object, you can edit the block to add attachment points or other parameters, actions and details. Simply right-click on the block and select “Edit P&ID Object’s Block…”.

This is a one-time conversion for one instance of your block. To add new block definitions to your project proceed to the next section.

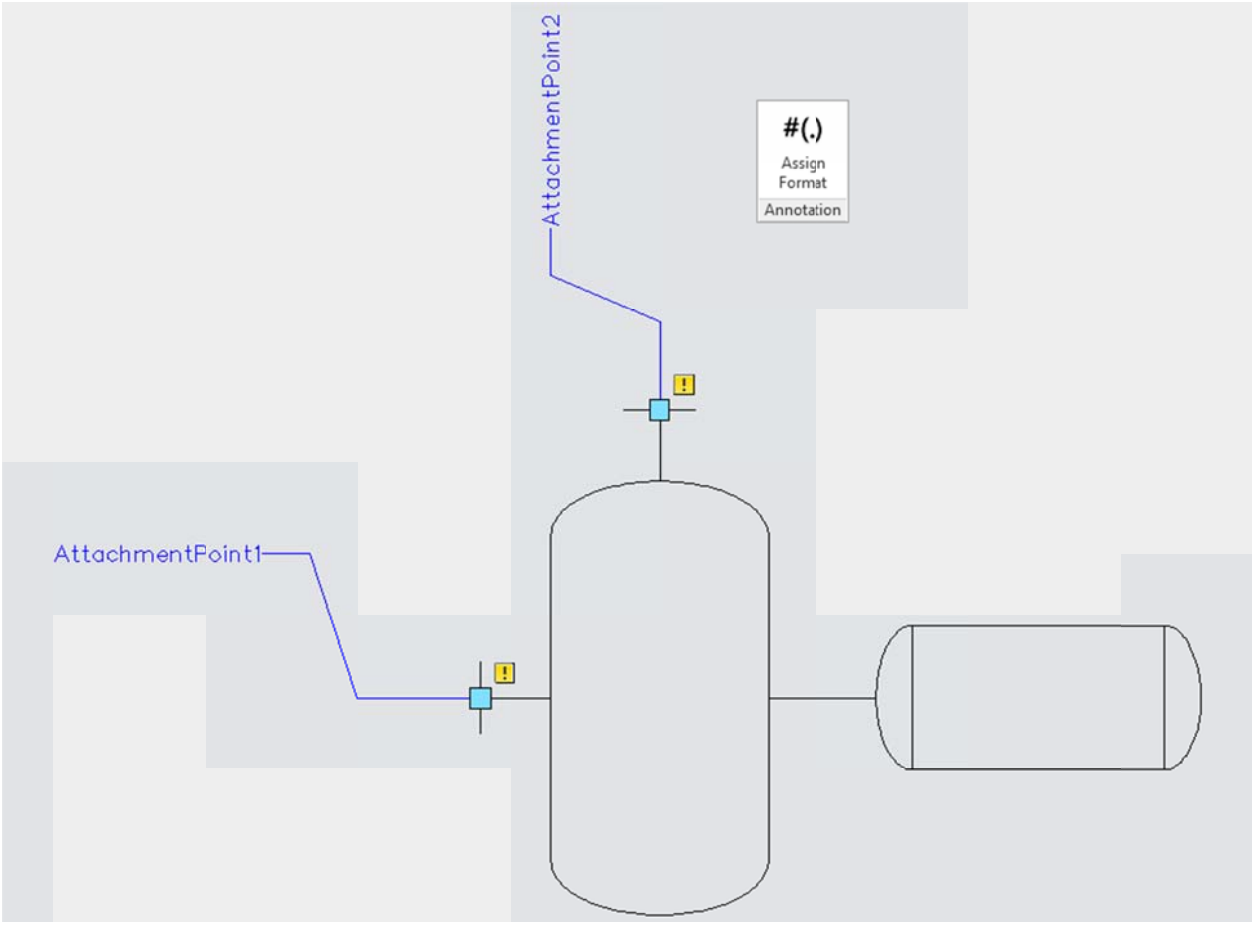
Adding a New Block to Your Project

Often you want to add custom symbols to be used throughout your project. It would be tedious to use the previous procedure for a block that will be used repeatedly. For this purpose there is a simple procedure to

add custom symbols (Blocks) to your project, to be accessed from the Tool Palette.

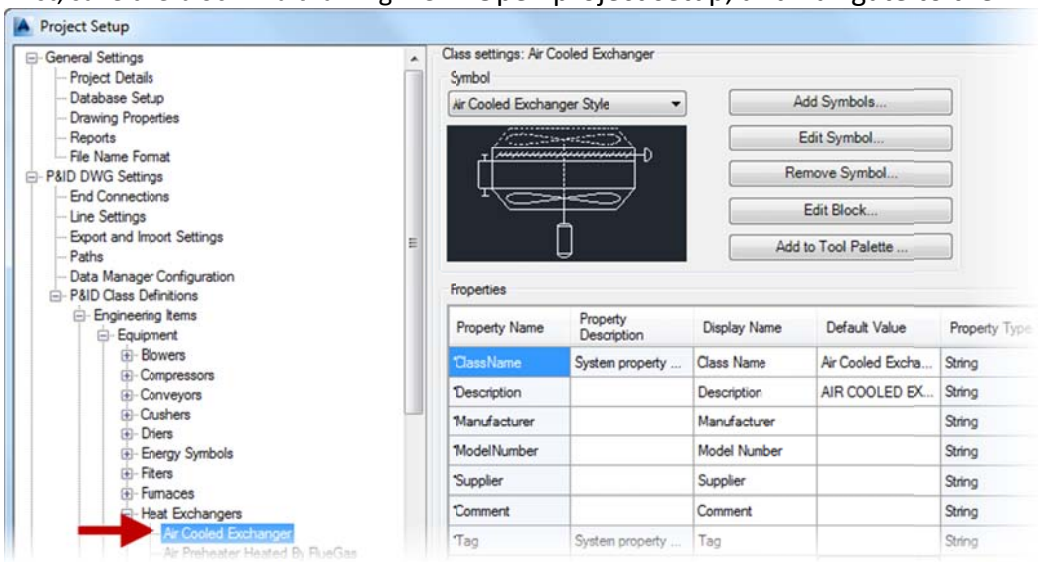
This procedure assumes you have saved an AutoCAD Block of your new symbol in a drawing. You can use the block you created in the previous section.

You should put attachment points on equipment, so when you draw lines they will preferentially snap to these nodes. You can also toggle attachment points on equipment as insertion points while placing the item. In particular, you need to add Point Parameter nodes called AttachmentPoint*n*. See the pump example below. (If you want to see some more examples, open ProjSymbolStyles.DWG and type BEDIT.)

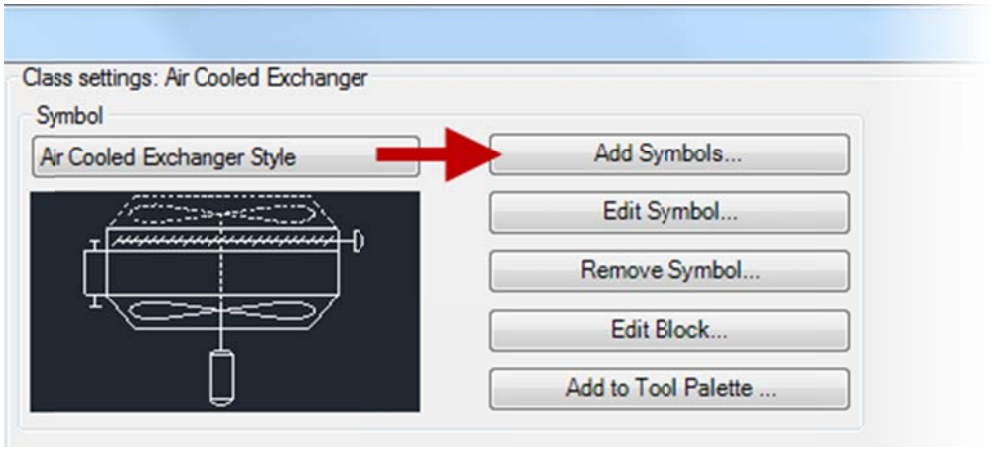


To Add a New Block to Your Project

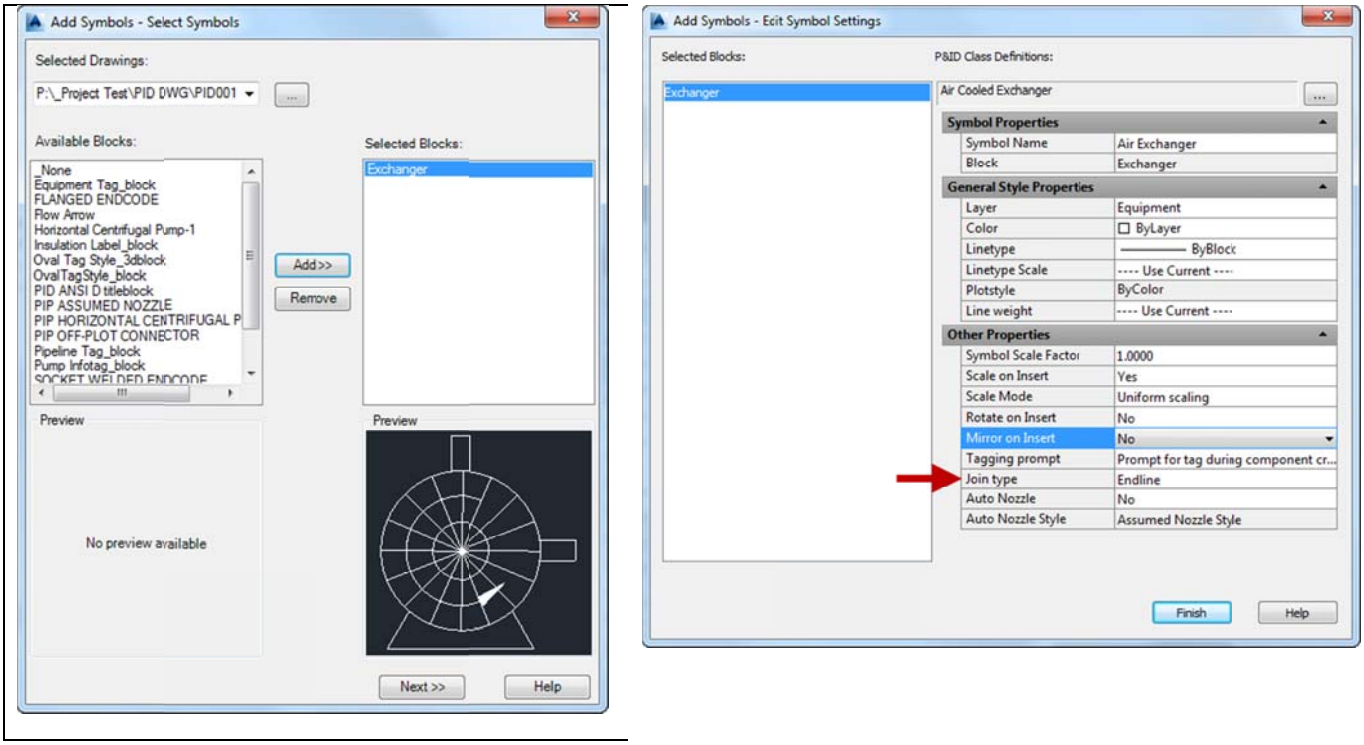
First, save the block in a drawing file. Open project setup, and navigate to the Air Cooled Exchanger.



Under symbol, click Add Symbol.



Locate the drawing with the block in it and select the block.



In the Symbol Settings dialog box, Symbol Properties, locate and click Symbol Name. Enter a new name for the symbol, and enter appropriate settings.

Data Properties

Set Up Properties

Properties are used to store information about a component or line that is in a P&ID drawing. Both components and lines contain different properties that are used to control how the component and line look when placed into a P&ID drawing. They also store non-graphical information that can be extracted out of the drawing. Properties for a component or line class definition can be defined as one of the following data types:

- **String.** Used for entering a free-form text value for a property.
- **Numeric.** Used to verify that only a positive or negative number is entered for a property.
- **Boolean.** Used to define a predefined list of choices that the user can select from for a property. The available values are restricted to true and false.
- **Symbol List.** Used to define a predefined list of choices that the user can select from for a property. The values that are defined for the list are used to control which symbol should be displayed for a

component in a P&ID drawing.

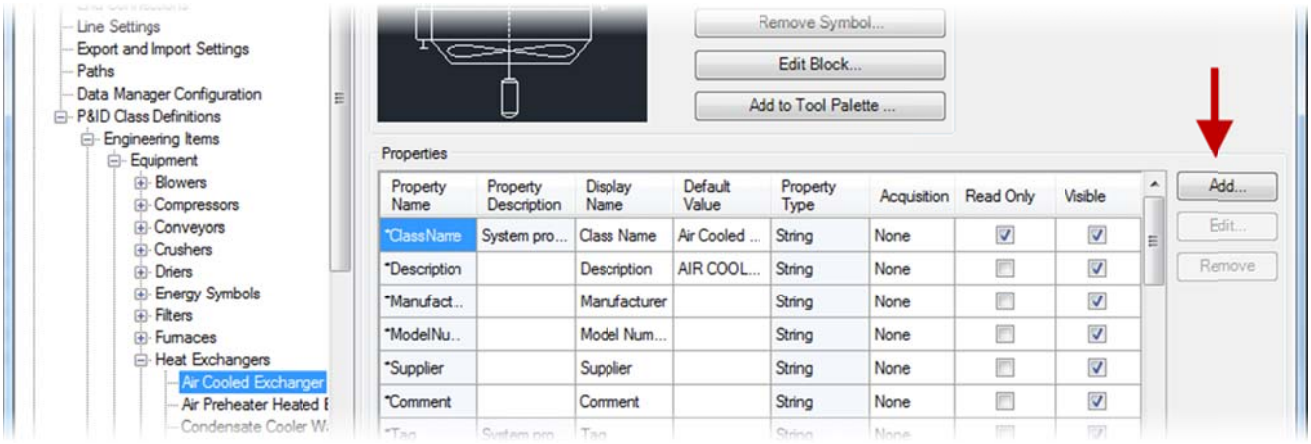
- **Selection List.** Used to define a predefined list of choices that the user can select from for a property. The predefined list provides consistency for property values. If a value you need isn't in the list, you can enter one as free-form text.
- **Acquisition.** Defines a rule stating that a component's property acquires its value from another property. For example, a rule states that a hand valve acquires its size from the corresponding property of a line. The source can be chosen from class, project, or drawing properties.

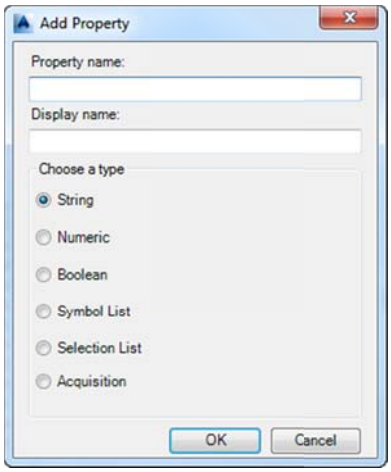
While AutoCAD P&ID is flexible and allows you to create your own properties, you should limit yourself to only the properties necessary for reports or annotations on drawings. Adding other properties adds complexity in editing and viewing part information.

Procedures: Set Up Properties

To add a property to a class definition

Open project setup, and navigate to the class to which you want to add a new property. Click the Add button.





In the Add Property dialog box, do the following:

- Under Property Name, enter a name for the new property. The name cannot contain any spaces.
- Under Display Name, enter the name you want to be displayed for the new property when using the

Data Manager or Properties palette.

- Under Choose a Type, select one of the available data types.

Click OK.

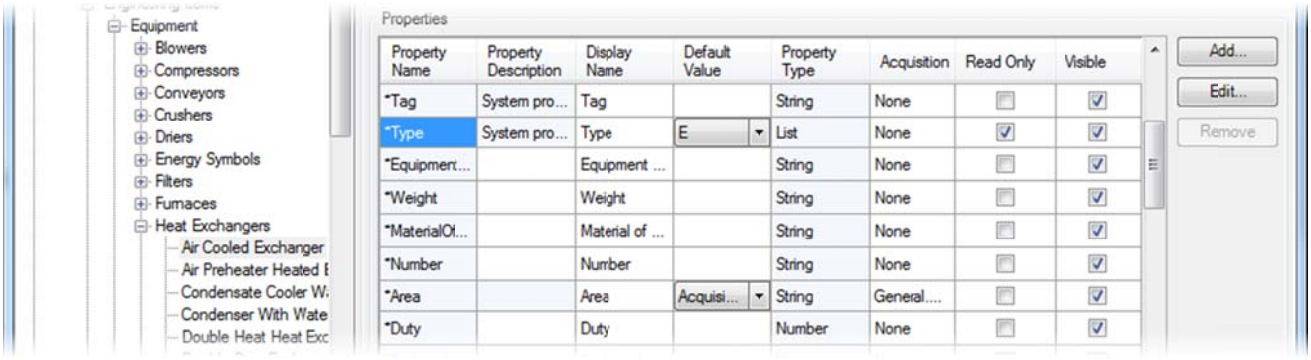
If you selected Selection List or Symbol List, the appropriate dialog box is displayed to let you create either a selection or symbol list.

If you selected Acquisition, the Select Data Source dialog box is displayed to let you select the source from which the property value is to be acquired.

Click OK.

To modify a property for a class definition

Go to project setup, and navigate to the class which contains the property you want to modify.



On the right pane, under Properties, locate and select the property you want to edit and then do one of the following:

Under Property Description, click the field and enter a new description.

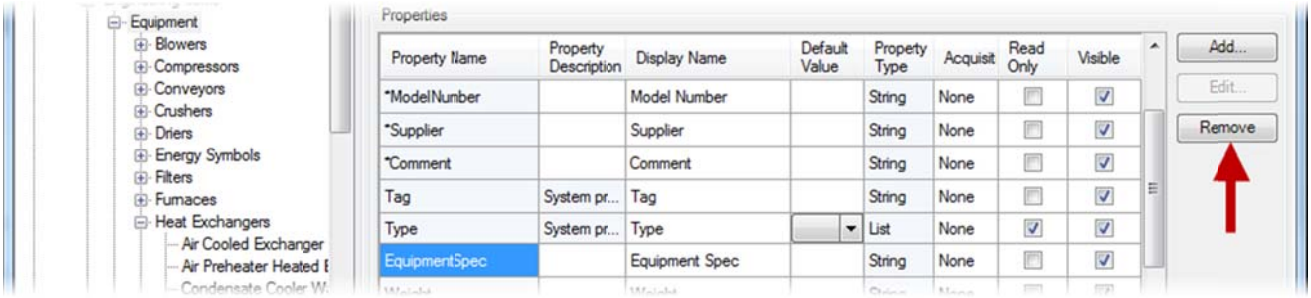
- Under Default Value, click the field and enter a new value or in the drop-down list, select one from the available list. If the default value is Acquisition, in the drop-down list, select an appropriate item.
- If the property is of the List property type, click Edit to change the selection or symbol list that is assigned to the property.
- Under Acquisition, click the [...] button and select Add acquisition rule. In the Select Data Source dialog box, select the source where the property value is acquired.

NOTE If you want to change the name of the property or its type, you must delete the property and then add it again.

To delete a property from a class definition

Go to project setup and navigate to the property you want to remove. Remember that properties with an * at the beginning of the name are inherited from a parent class and may not be removed from the child class.

Highlight the property to remove in the properties pane and click Remove.

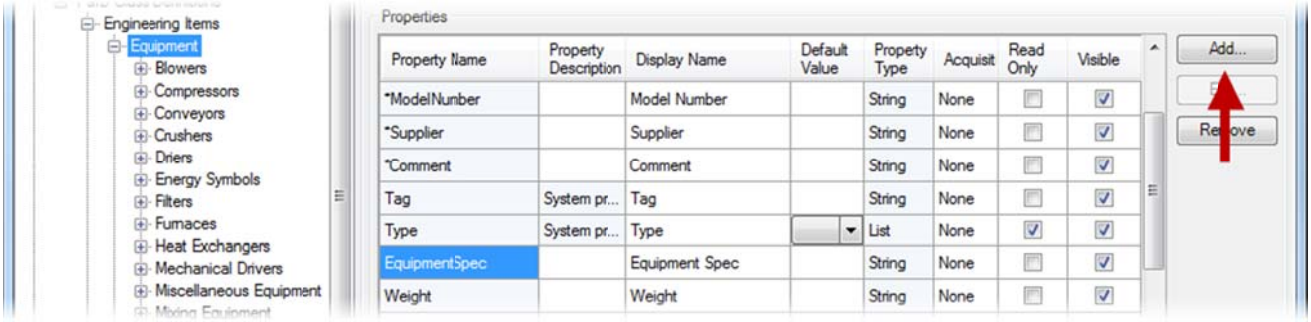


Exercise: Adding new properties

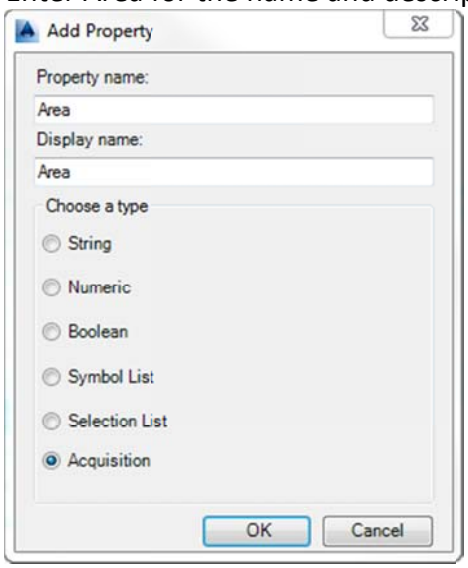
In this exercise we will add a new Equipment property called Area, whose value is acquired from the Drawing Property Area.

Go to Project Setup, and Navigate to the Equipment class, click Add.

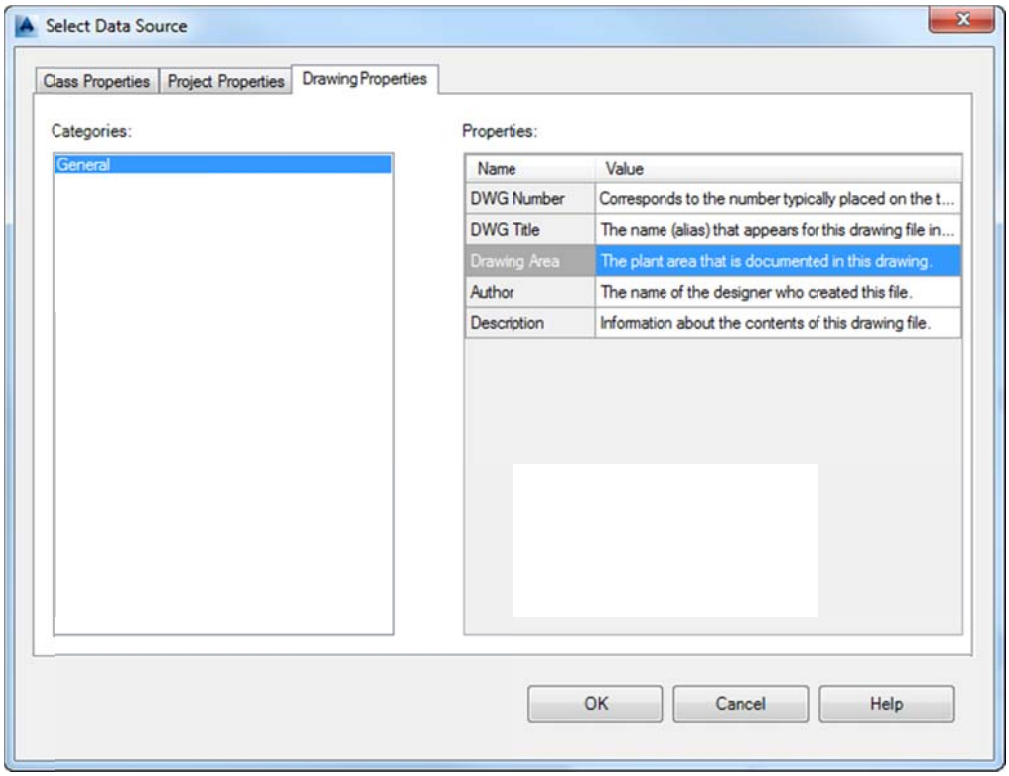
1 In Project Setup, navigate to Equipment. 2 In the right panel under Properties click on the Add button.



Enter Area for the name and description, and choose the Acquisition type.



Click on the Drawing Properties tab and select Area.



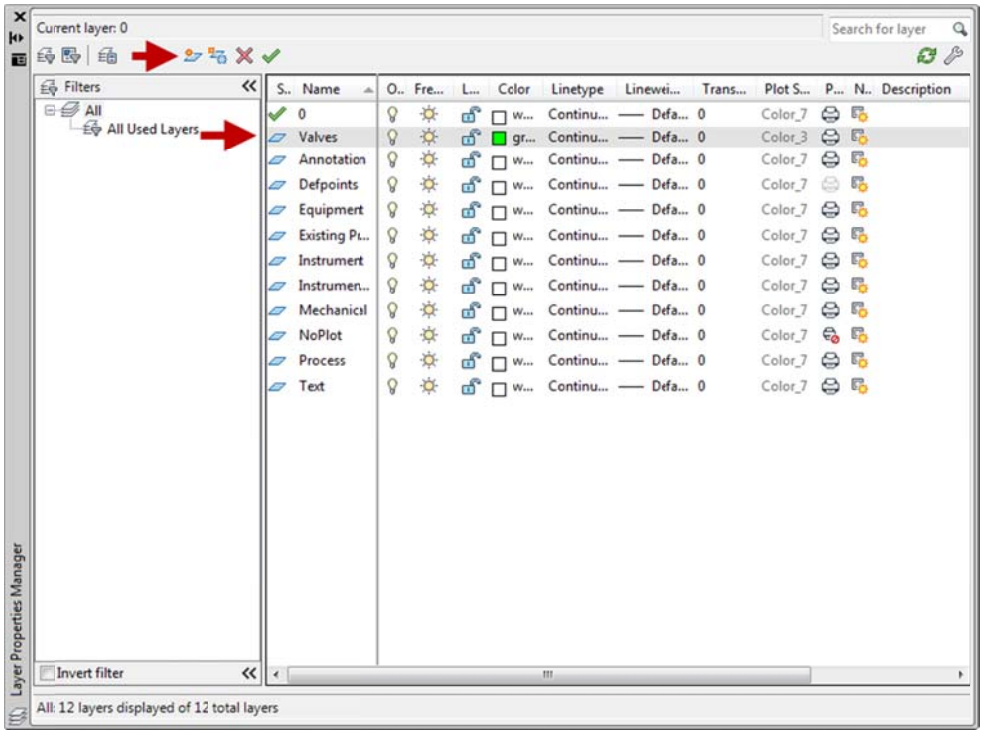
Now the Equipment property Area acquires its value from the drawing property Area. All equipment subtypes will now have a property called Area which acquires its value from the drawing.

Layers & Colors

All the symbols and "styles" in AutoCAD P&ID are stored in a drawing called ProjSymbolStyles.DWG. You will find one copy of this drawing in the project folder for each project. The layers in this drawing control the layers that you can choose when in project setup. More specifically, the layers in this drawing control the layers to which you can assign P&ID components.

So if you want assign components, slines or annotations to, say the Valves layer, you do the following:

1. Open the project ProjSymbolsStyles.DWG.
2. Bring up the Layer Property Manager dialog from the layer toolbar or by typing layer on the command line.
3. Create a layer called Valves using traditional AutoCAD techniques. This can be done via the new layer icon button.



You can set the layer colors & linetypes here – but more often it is set in the DWT file. As long as the DWT has these same layers, then the system will get the DWT layer settings. We're also going to add Valves to a DWT.

In a real-world scenario, you would make the modification below to a template that is stored on your network.

Start with the user DWT that was installed with the software:

C:\Users\%USERNAME%\Local Settings\AppData\Local\Autodesk\AutoCAD Plant 3D 20XX\RXX.X\enu\ PID ANSI D -Color Dependent Plot Styles.dwt

1. Copy it into a new file which you should name *Training PID ANSI D Template.dwt*
2. Leave *Training PID ANSI D Template.dwt* in the same folder. For actual projects, you might want to move your project DWT into the project folder.
3. Open this DWT in AutoCAD.
4. Add the Valves layer, and set the color, as shown above, in the projSymbolStyles.dwg editing (this is done from the Layer Properties

Manager). S

5. Save and close *Training PID ANSI D Template.dwt*

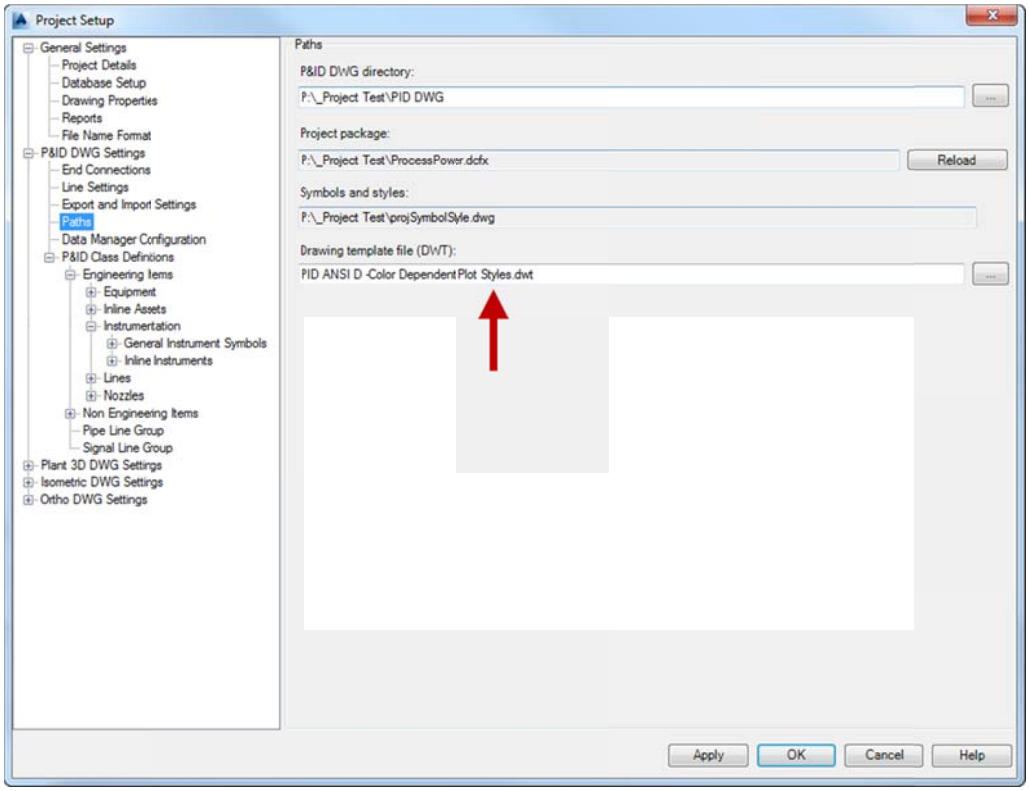
***HINT**: If you are starting your DWT from scratch, design center allows you to drag & drop layers from any DWG/DWT in the tree onto the current drawing. So you could easily drag layers from ProjSymbolStyle.DWG into your DWT.*

Speaking of DWT files; AutoCAD P&ID ships with 8 sample DWT files that can be used as a starting point when creating your project's DWT.

***NOTE:** Don't change out of the box files without having a backup/restore plan!*

***NOTE:** If/when making your own DWT, it is highly recommended that you turn wipeout frames off. Otherwise, your instruments and other annotations will look incorrect, and will have boxes around the text. Use the WIPEOUTFRAME system variable to manage the wipeout status.*

Any new P&ID drawing will use the DWT specified in Project Setup. The Project Setup dialog has a place in the Paths node to indicate the desired DWT (this is why you can put project specific DWT files in the project folder). Change the Drawing Template here to point to the one we created.



Where you set the DWT for a project Set the path to the DWT to the *Training PID ANSI D Template.dwt* you created earlier. Any P&ID created in this project will use this DWT and subsequently have the layer "Valves" defined within. You will see the Valves layer in the next section when you add a symbol.

You get to specify one and only one DWT per project. If you want to use a different DWT than the one specified in your path, you can use the FILE-NEW menu and browse to a different DWT. Save the drawing and add it to the project. However, if you add folders in the project manager and organize your P&IDs within those, you can have a template for each folder.

Component Characteristics

Set Up Class Definitions for Components and Lines

Class definitions are used to define the attributes and properties of a component or line before they are placed into a P&ID Drawing. To create most equipment, instruments, lines, inline items, and nozzles, you start with an existing component and you edit that component (block). The general structure of the built-in symbols should be followed. In several cases, specific behavior is tied to classes being built with the correct parent. For example, in order to reducers to act properly, they must be created under the reducer class.

Class definitions are organized into four different main class definition families that are used to define the components and lines that are placed in a drawing. The main class definition families are as follows:

Engineering items - Includes equipment, nozzles, instrumentation, inline components, and lines.

Non-Engineering items - Includes items that are not counted in reports, including flow arrows, gap, actuators, connectors, annotations, segment breakers, and others

Pipe line group - Includes pipe lines.

Signal line group - Includes signal lines which are used in combination with instruments.

You can modify existing class definitions or create your own based on an existing class definition. For example, your company might use a different kind of pump than the pump symbols provided in the product. You can create your own pump symbols that all of your drafters can use.

When you create or modify a class definition, you can modify the following properties:

> **Symbol or line settings -** The name of the symbol or line style, name of the block used to control the geometry that is displayed in the drawing after a component is inserted, layer, color, line-type, line-type scale, plot style, and line-weight that a component is inserted with. Along with other settings that affect how the insertion of a component, or how a schematic line is drawn.
>
> **Properties -** The values that are assigned to a component or line class definition to determine how it looks and behaves in a P&ID drawing, along with which values are attached to the component or line (such as default value, description, and others).
>
> **Tag format -** The information used to construct a unique tag for a component or line.
>
> **Annotation style -** The text and symbol settings used to annotate a component or line.
>
> **Substitution -** Turn the substitution palette off by setting this property to false. The default value is true.

When you create new class definitions based on a class definition family or parent, the new class definition inherits the properties and settings assigned to the family or parent class definition. In addition to creating and modifying class definitions, you can also rename and purge class definitions as long as they are not currently being used in a drawing that is part of the project

Procedures: Set Up Class Definitions for Components and Lines

To create a new component or line class definition

Navigate to P&ID Class Definitions, and select the class definition or class definition family on which you want to base the new class definition. Select a class definition that most closely represents the class definition you want to create. The node you select is used as the template for the new class definition.

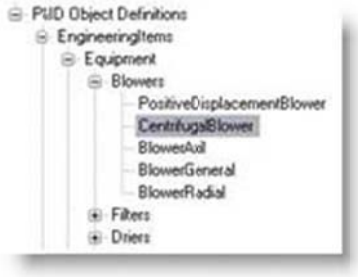
1. Right-click over the selected class definition.
2. Click New.
3. In the New Class Definition dialog box, enter a name for the new class definition.

4. Click OK.
5. In the tree view, expand the node to which new class definition was added, and select the new class definition.
6. On the right pane, make the desired changes.
7. Click OK

To change a class definition for a component or line

Navigate to the P&ID Class Definitions, and select an item (for example: *Engineering Items* ➢ *Equipment*) that contains the class definition you wish to change.

Continue to expand the lists until you find the item (for example: *Blowers* ➢ *Centrifugal Blower*) whose definition you want to change.



The P&ID Class Definitions tree view contains values that are inherited from the parent item (in this example, *Blowers*).

Property Name	Property Description	Display Name	Default Value	Property Type	Acquisition	Read Only	Visible
*ClassName	System prc...	Class Name	Centrifugal...	String	None	☑	☑
*Description		Description	CENTRIF...	String	None	☐	☑
*Manufact...		Manufactu...		String	None	☐	☑
*ModelNu...		Model Nu...		String	None	☐	☑
*Supplier		Supplier		String	None	☐	☑
*Comment		Comment		String	None	☐	☑
*Tag	System prc...	Tag		String	None	☐	☑
*Type	System prc...	Type	B	List	None	☑	☑
*Equipmen...		Equipment ...		String	None	☐	☑
*Weight		Weight		String	None	☐	☑

Change the graphical style for the selected class or line definition.

- If you are modifying a class definition, under Symbol, add, modify or remove the symbols for the selected class definition.
- If you are modifying a line definition, under Line, edit the properties for the selected line style.

Under Tag Format, add, modify or remove tagging formats associated with the selected class or line definition.

Under Annotation, add, modify or remove annotation styles associated with the selected class or line definition.

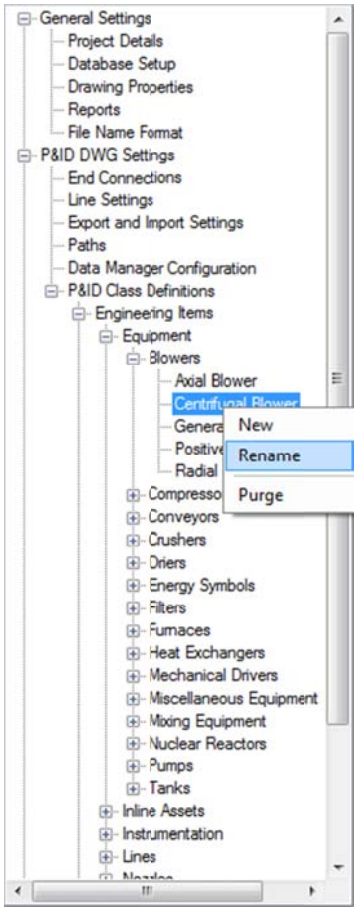
Under Properties, do the following:

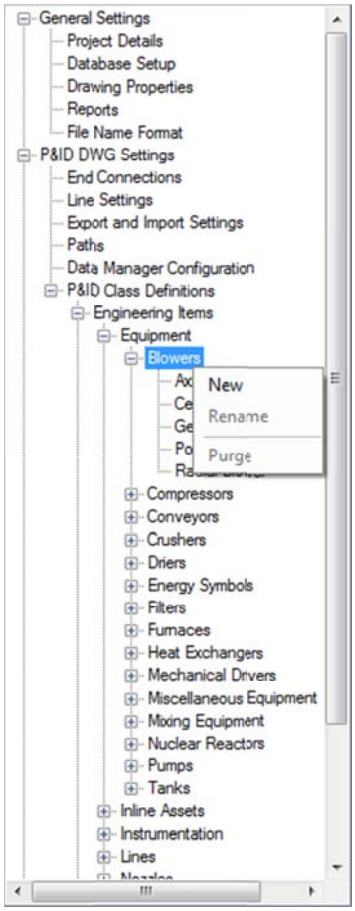
- Change the value for the Display Name property. (This information is displayed in the Data Manager.)
- Change the value for the Default Value property.
- Add or remove custom properties as needed for the class or line definition.
- Change the values of properties other than Display Name and Default Value as needed, such as tagging format, annotation style, and graphical style.

Click OK.

To rename class definition for a component or line

Go to project setup, and navigate to the class you want to rename. You can only rename classes that do not have any children.





To purge a class definition for a component or line

In project setup navigate to the class you wish to purge. You can only purge classes that do not have any children and that do not have any symbols in any of the P&IDs. If the class has symbols a dialog will inform you.

WARNING There is no way to undo the purging of a class definition, so if you accidently remove the wrong class definition click Cancel. This will undo all the recent changes that you made in the Project Setup dialog box.

Set Up Symbol and Line Settings

Component and line class definitions have assigned settings that control graphically how they are displayed in a P&ID drawing.

Component and line class definitions are defined by two different types of settings and properties graphical and non-graphical. The graphical settings and properties affect how the component or line is represented in a P&ID drawing. Non-graphical properties are used to identify one component or line from another.

For a component, you can specify a symbol and the settings that should be used to control the insertion behavior of a component. For a line you can specify whether flow arrows are used to indicate the flow direction through a pipe.

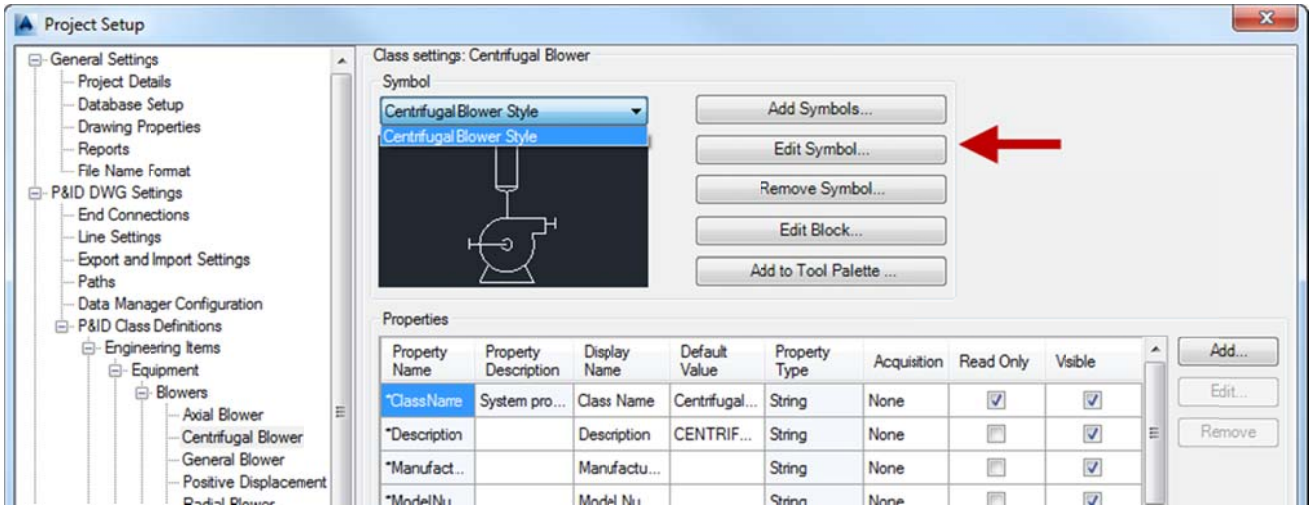
You can create class definitions for both components and lines for general graphical properties such as layers, colors, smart line types, linetypes, and lineweights.

NOTE If your project is based on a standard that represents some pipelines as multiple lines (DIN 2481, for example), you can select mline (multiple line) as the smart line type and then select from the various mline styles. The DIN standard, represents oil, air, solid fuels, and so on, with multiple lines.

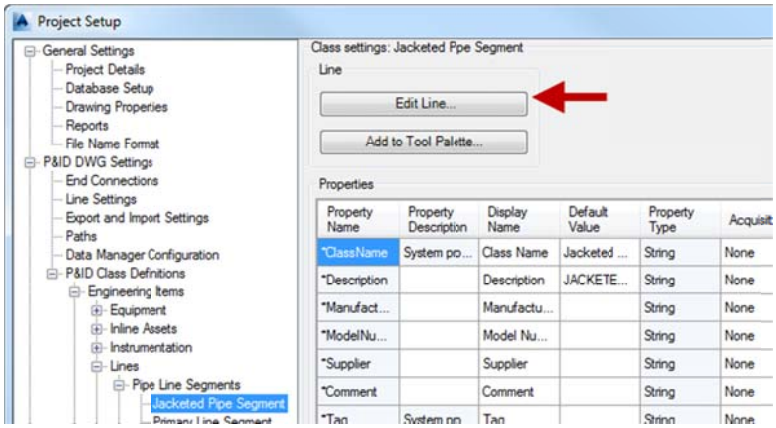
Procedures: Set Up Symbol and Line Settings

To change linetypes for components and lines

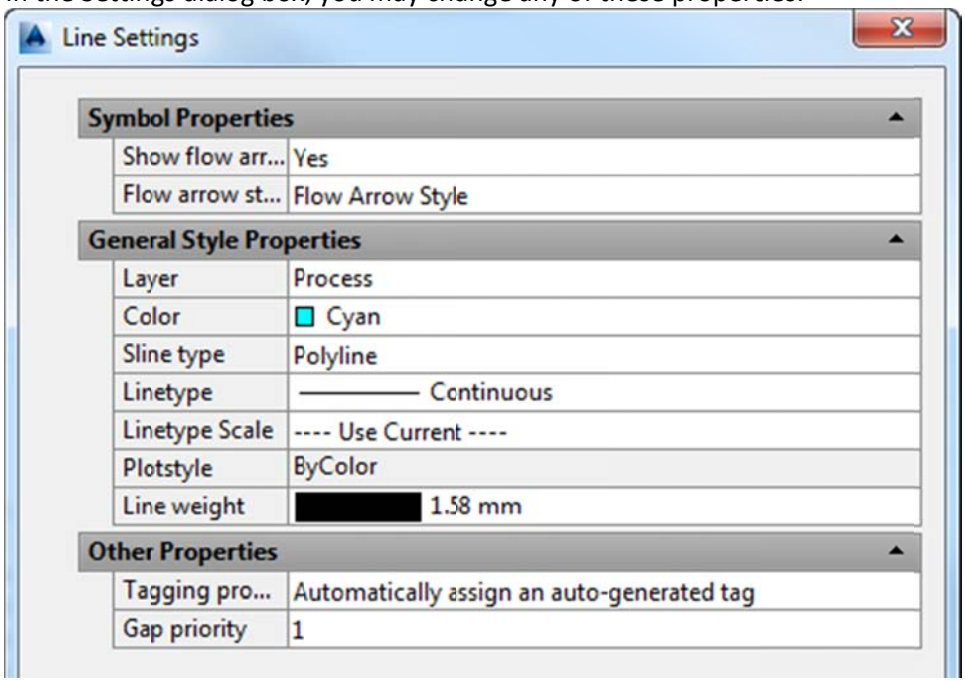
In project setup navigate to the class you want to change. For symbols, select the symbol to change from the dropdown, and click edit block or edit symbol.



For lines, click the Edit Line button.



In the Settings dialog box, you may change any of these properties.

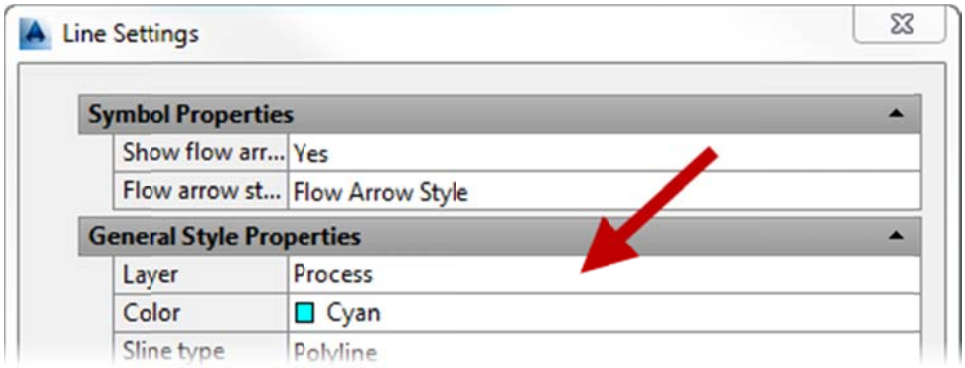


NOTE If your project is based on the DIN 2481standard and the pipe lineyou want to change is represented by multiple lines, make sure that the Smart line type is Mline and click Mline style. In the drop-down list, select a new mline style.

When drafters place the component in a drawing or create a schematic line, it is displayed with the type of line you defined here.

To change layers and colors for components and lines

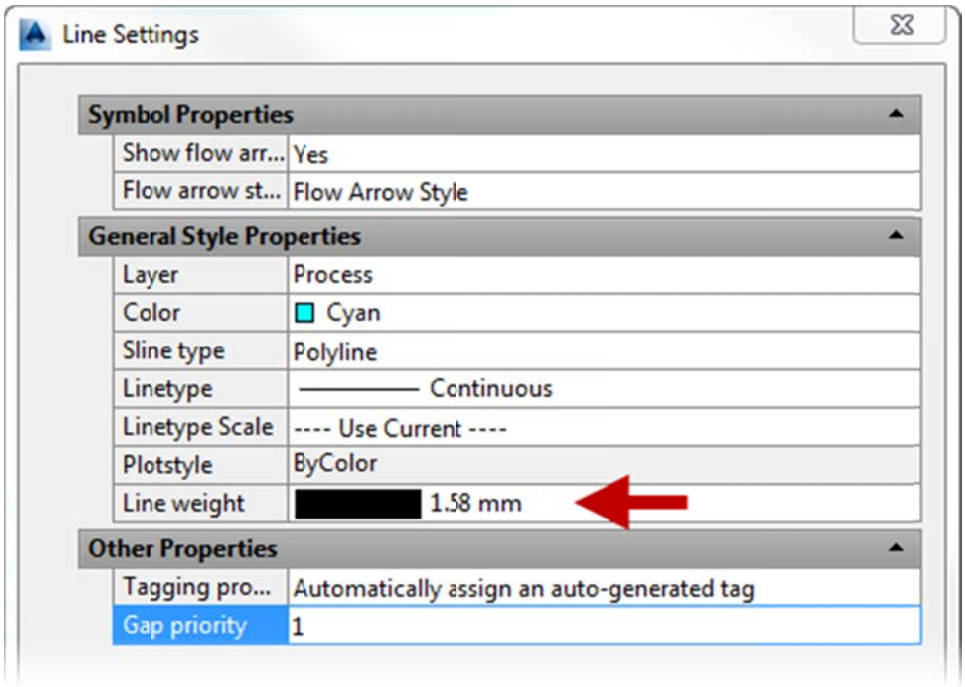
In project setup under P&ID Class Definitions, locate and select the component or line you want to change the layer and color for. Edit the Symbol or line and choose the layer or color value.



When drafters place the component in a drawing or create a schematic line, it is displayed on the layer and in the color you defined here.

To change lineweights for components and lines

In project setup under P&ID Class Definitions, locate and select the component or line for which you want to change the line weight. Edit the Symbol or line and choose the lineweight.



When drafters place the component in a drawing or create a schematic line, it is displayed with the line weight you defined here.

Configure Symbols for Components

Symbols are a graphical representation of a component in a P&ID drawing. They also control the insertion behavior that is used when adding a component to a P&ID drawing.

If your company has a set of standard blocks that you use, you can use those blocks to define the symbols that are assigned to a component.

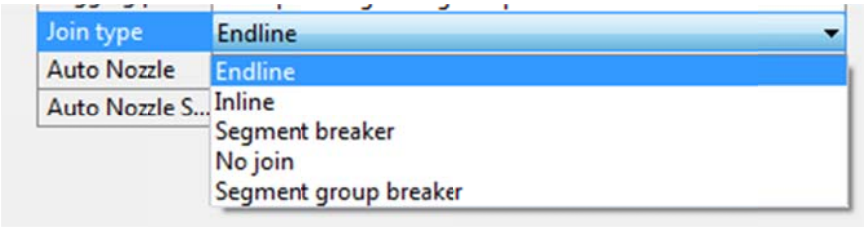
You can create new symbols for a component or modify existing symbols. Use the Block Editor to edit a symbol block or to define settings that control how the symbol is inserted. After you define a symbol, you can specify the default symbol that a component uses.

You can also remove the symbol for a class definition. Before removing a symbol, the program checks if the symbol is assigned to the class definition. If the symbol is assigned, you are notified that it cannot be removed.

If a symbol is assigned to a value in a symbol list or to a component in a P&ID drawing, the value can be removed from the symbol list or unassigned for the property of a component without any loss in visual fidelity to the component in the drawing.

Join Type

The join type governs how a component interacts with other items.



The end line join type is used for equipment or other items that force the line group to terminate. The inline join allows components to be inserted in the middle of the line and have automatic breaking and rotation. The segment break join type divides one line segment into two parts, but keeps them within the same line group. The segment group break forces a break in the segment and in the line group. No join acts like a standard AutoCAD object and doesn't interact intelligently with any part.

Scale Components

Most components in AutoCAD P&ID are at a scale of 1:1, and are either unit-less or in the unit format based on the selected standard. The scale factor for inserting a component is defined as a property of the symbol that is assigned to the component class definition.

When defining the scale factor for a component, you choose whether or not the component is scaled uniformly. Most blocks are scaled uniformly along the X and Y axis. An example of when you might want to scale a block non-uniformly would be if you want to create multiple tank components with different widths while using a single block for the different-sized tank components in a drawing.

Understand Attachment Points on Components

Attachment points are snap points on a component that connect multiple components and connect a schematic line to a component. Attachment points validate that when a component is placed in a drawing, it is fully connected with schematic lines.

Although blocks used for the symbols of components do not require attachment points, it is strongly recommended that you use them in the blocks that you create, and that you do not remove or change the

order of the attachment points in for the blocks that are included with AutoCAD P&ID.

Attachment points are used in components such as pumps and blowers to determine that the connections in a drawing represent the available connections on the real-world items. Inline components such as valves have attachment points that connect them to other inline components. When you place an inline component on a schematic line, its attachment points validate that the schematic line is properly broken.

Define Attachment Points

You define attachment points in a block with the Block Editor and Point parameters. Each Point parameter that you want to use as an attachment point must follow a specific labeling convention, "AttachmentPoint" + [Numeric Suffix]. For example, the first attachment point for a block would be labeled AttachmentPoint1, the second attachment point would be labeled AttachmentPoint2, and so on.

If an attachment point is being defined in a block for a hand valve, you must also define the rotation angle of the end connection by using the labeling convention "AttachmentPoint" + [Numeric Suffix] + ":EndCode" + [Rotation Angle in Degrees]. For example, a block might have a Point parameter with the label AttachmentPoint1:EndCode90 for one of its attachment points. The label AttachmentPoint1:EndCode90 indicates that it is the first attachment point for the block and that the end connection at the attachment point is to be rotated 90 degrees. If you don't want to use end connections with a block for a hand valve, then use the labeling convention "AttachmentPoint" + [Numeric Suffix].

To snap to an attachment point on a component, you use the Node class snap. The Node class snap also snaps to a Point class contained in a block or drawing.

In cases where the block completely covers the line behind it, attachment points do not need to be defined.

Guidelines for Orienting Attachment Points

Most inline components, such as those found on the Fittings and Valves tabs of the PIP Tool Palette, are horizontally oriented by default. Their attachment points fall on the X axis, following the flow of a horizontal line either to the left or right. Some components, however, are oriented by default along the Y axis. If you place such a component, for example, a flame arrestor, on a horizontal line, it automatically rotates to align with the line's direction.

When configuring symbols for components, keep in mind the following guidelines:

- The imaginary vector drawn from Attachment Point 1 (AP1) to Attachment Point 2 (AP2) defines the direction of the component.
- Most components are horizontally oriented, with the vector along the X axis.
- Some components, such as Flame Arrestors, have AP1 to AP2 along the positive Y axis. These are vertically-oriented components.
- If the vector is non-orthogonal, it is ignored.

NOTE These guidelines do not apply to items on the Equipment tab of the tool palette or to General Instruments on the Instruments tab. Equipment (endline components such as tanks and pumps, for

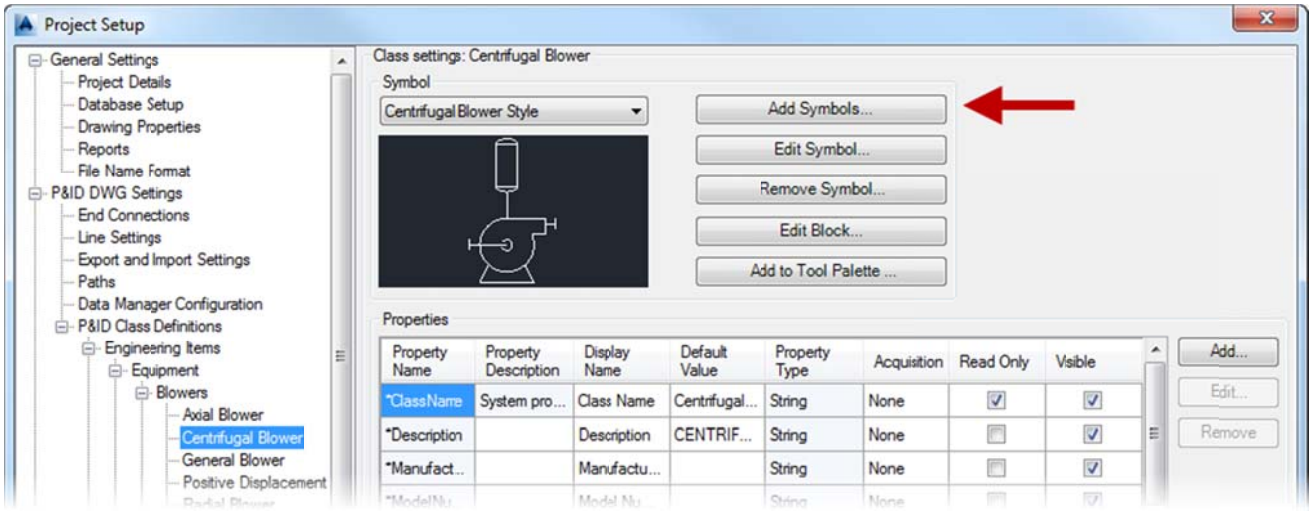
example) cannot be inserted inline. Similarly, General Instruments, which contain text inside graphics, cannot be inserted inline.

Procedures: Configure Symbols for Components

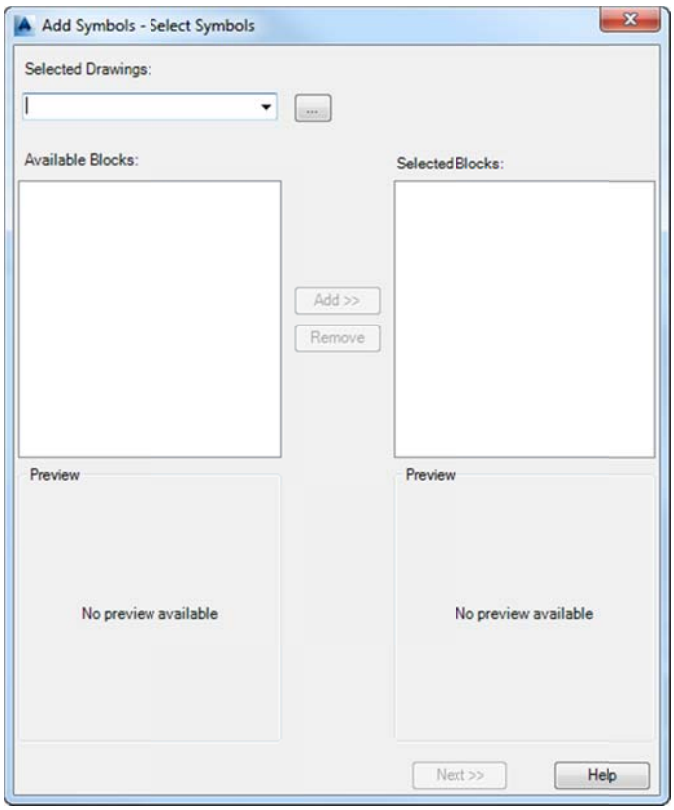
To add or remove a symbol to a component class definition

In project setup navigate to the class to which you want to add or remove a symbol.

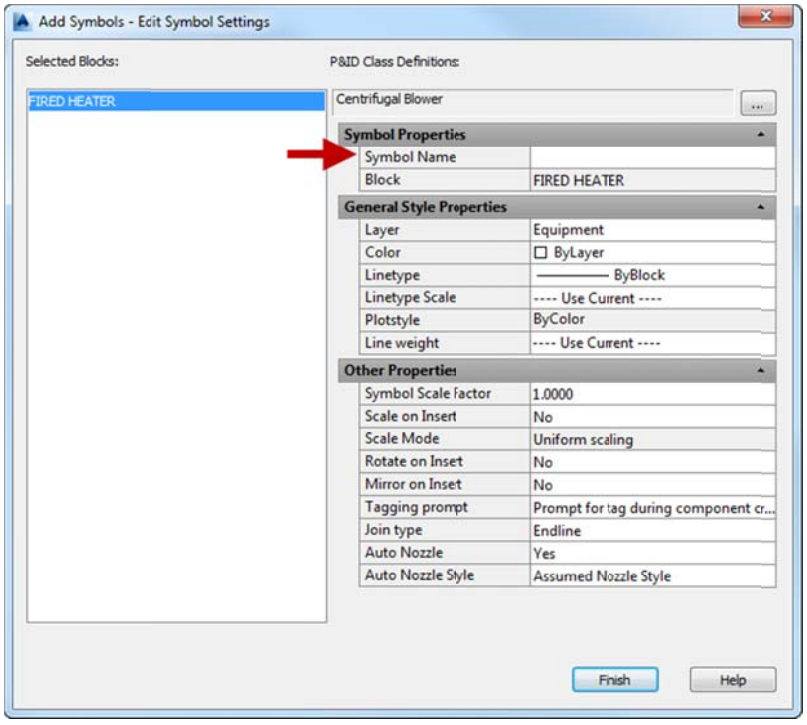
To add a symbol, click Add Symbol



In the Add Symbols dialog, browse to a drawing that **contains** the symbol you want to add. Locate it in the list, click Add and then Next.



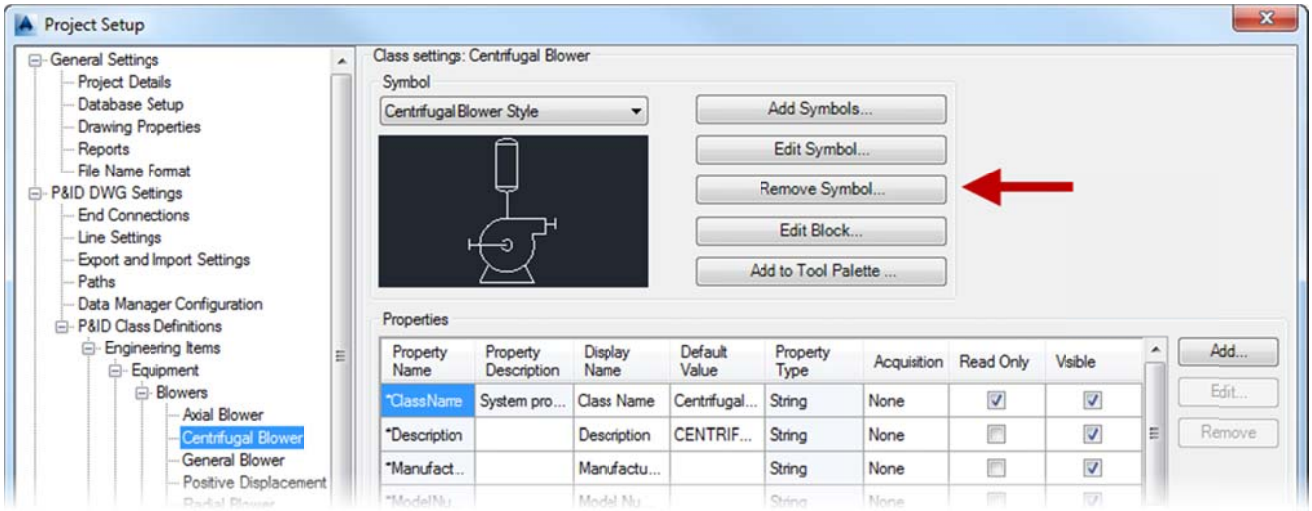
In the Symbol Settings dialog box, Symbol Properties, locate and click Symbol Name. Enter new name for the symbol.



Fill out the rest of the properties as is appropriate for the symbol you are Adding.

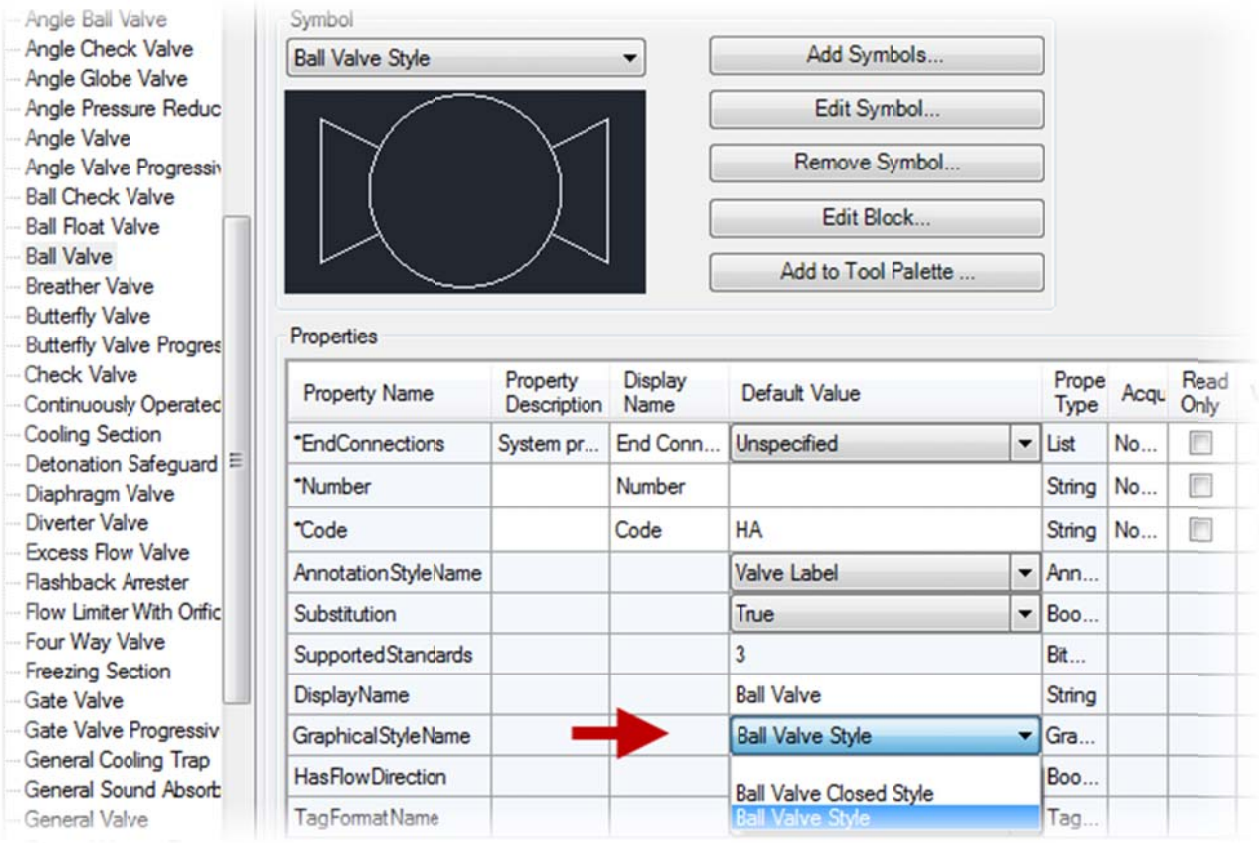
To remove a symbol for a component class definition

Navigate to the class that contains the symbol, select the symbol from the drop down and click Remove.



To set the default symbol for a component class definition

In project setup navigate to the class you want to modify. On the right pane, under Properties, locate GraphicalStyleName under the Property Name column. In the GraphicalStyleName row, under the Default Value column, in the drop-down list, select the symbol you want to use as the default symbol when inserting the component into a P&ID drawing.

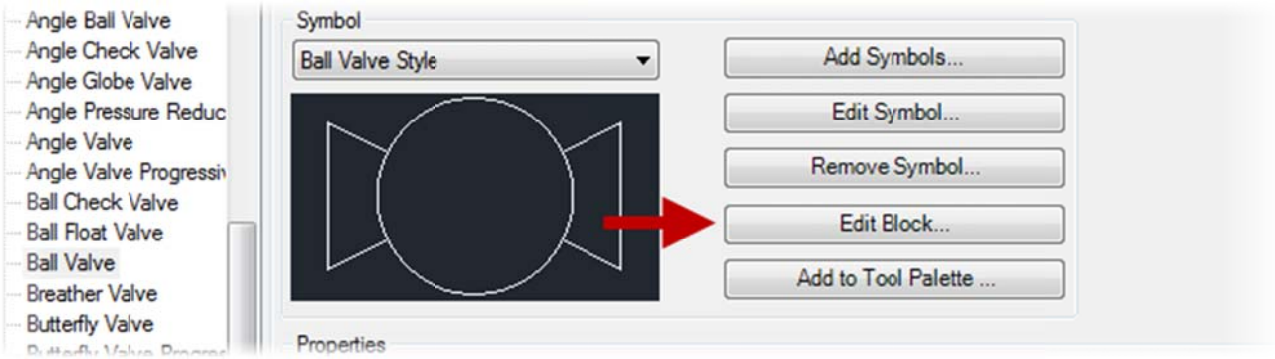


To edit a symbol for a component class definition

In project setup navigate to the class you want to modify. On the right pane, under Symbol, in the drop-down list, select the symbol that you want to edit. Under symbol, click Edit Symbol. In the Symbol Settings dialog box, make changes to the properties for the symbol under Symbol Properties, General Styles Properties, and Other Properties. Click OK.

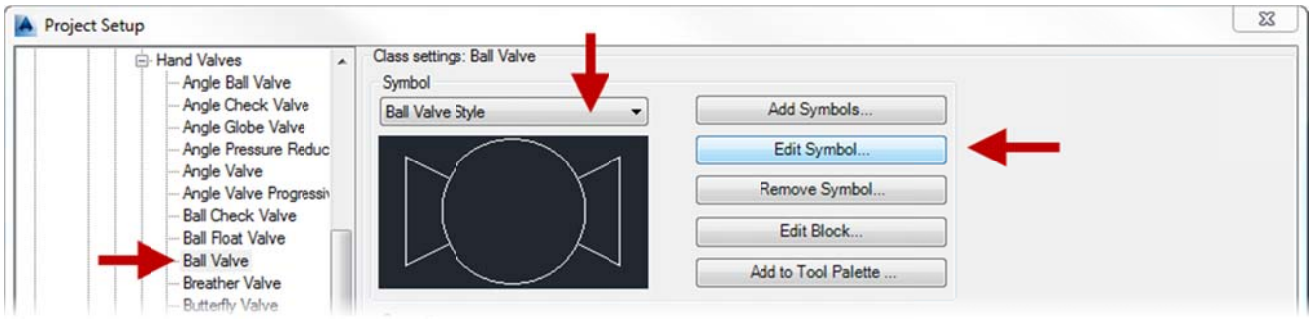
To edit the block associated to a symbol

In project setup navigate to the class you want to modify. Locate and select the component you want to change the default symbol for. On the right pane, under Symbol, in the drop-down list, select the symbol that contains the block that you want to change. Under symbol, click Edit Block. In the Block Editor, change the geometry for the block as needed. Click Close Block Editor, saving the changes.



To set a component's scale factor

In project setup navigate to the class you want to modify. Locate and select the component you want to change the scale for.



Under symbol, click Edit Symbol.

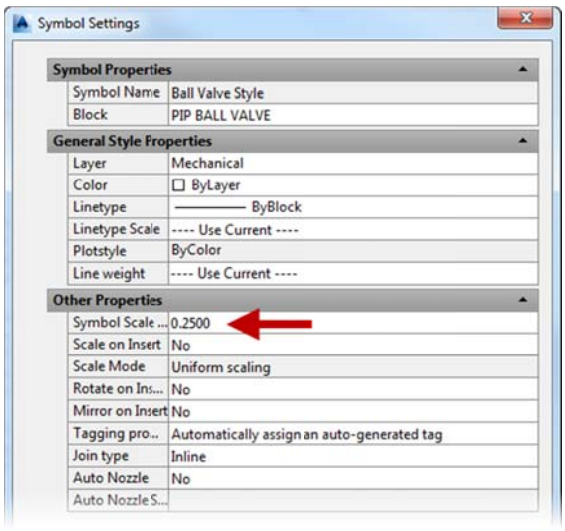
In the Symbol Settings dialog box, Other Properties, locate and select Symbol Scale. Enter a scale factor.

To set prompting behavior for drafters to scale a component when they insert it in a drawing, click Scale on Insert, and from the list, select Yes.

To set scaling behavior, click Scale Mode, and from the list, select either of the following:

- **Uniform scaling**: Sets the component to scale proportionately both vertically and horizontally.
- **XY independent scaling**: Scales the component to scale independently both vertically and horizontally, depending on which direction you move the cursor.

Click OK to close each dialog box.

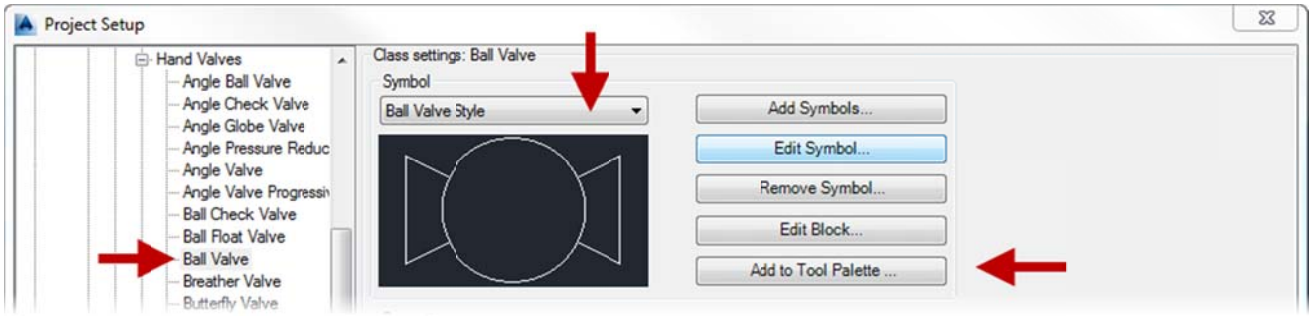


When drafters place this item in a drawing, it has the scaling behavior you defined here.

To add a component to the tool palette

NOTE Before you start this procedure, make sure the P&ID tool palette is displayed.
In project setup navigate to the class you want to modify. Locate and select the class you want to add to a tool palette.

Click the Add to Tool Palette button.

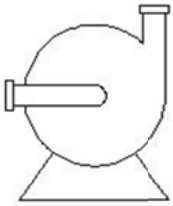


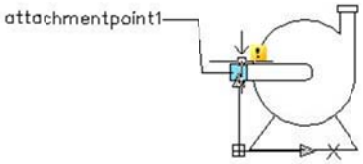
To create a component with attachment points and add it to the tool palette

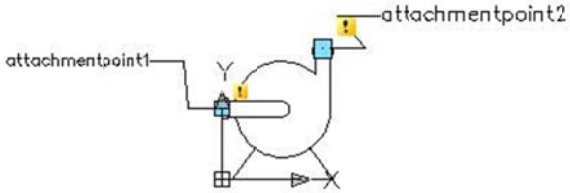
The following procedure illustrates how you would create a pump (an endline component) and define two attachment points (where schematic lines will snap). You can create other components using the same general steps. Not all components require attachment points (for example, tanks do not require them) unless you want to define them.

NOTE Before you start this procedure, make sure the P&ID tool palette is displayed in your drawing and that the active tool palette tab is the one where you want to add the new component (for example, if you are adding a pump to the tool palette, make sure the Equipment tab is active).

1. Create a new block (for example: a horizontal centrifugal pump). Save the drawing file.
2. Click Tools menu ➢ Block Editor.
3. In the Block Editor dialog box, click Current Drawing, and click OK.
4. Make sure Midpoint snaps are off.
5. On the Parameters tab of the Block Authoring palette, click Point Parameter, and place a parameter (for example: on the inlet of the pump).
6. Right-click the parameter. Click Properties.
7. In the Properties palette, Property Labels, enter **attachmentpoint1**.
8. Click anywhere in the drawing, and then press ESC on the keyboard.
9. Create another parameter (for example: at the outlet of the pump), and label it **attachmentpoint2**.







10. Save the changes and close the Block Editor.
11. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
12. Continue to expand the tree until you find the component you want to base the new class definition on (for example: Equipment ➢ Pumps ➢ Centrifugal Sump Pump).

13. Right-click over the selected class definition. Click New.

NOTE Instead of creating a new class definition, you can also add a new symbol to an existing class definition. To add a new symbol to an existing class definition, see To add a symbol to a component definition.

14. In the New Class Definition dialog box, enter a name for the new class definition (for example: horizontal centrifugal pump).
15. Click OK
16. Expand the node that the new class definition was added to, and select the new class definition.
17. On the right pane, under Symbol, click Add Symbol.
18. In the Symbol Settings dialog box, under Symbol Properties, do the following:
    a. Next to Symbol Name, enter a name for the symbol that is being added to the new class definition.
    b. Next to Block, click the [...] button, and navigate to the drawing you created in step 1.
    c. Select that drawing and in the Select Block dialog box, select a symbol name (block) from the list. Click OK.
    d. (Optional) Make other changes to the settings of the component you just created.
    e. Click OK.
19. On the right pane, make the desired changes to the new class definition's properties, tag format, and annotation style.
20. Under Symbol, click Add to Tool Palette. The new class definition is added to the active tool palette. The new tool can be used just like the default tools provided with AutoCAD P&ID, and will be included in reports.

NOTE If the tool palette is not open when you click Create Tool; the component is still added to the bottom of the last-active tool palette.

Configure the Appearance of Lines

You can set up the arrow behavior of lines. You set up whether a flow arrow is displayed when a line is added to a drawing (not all lines need a flow arrow), and the type of flow arrow symbol that is displayed in the drawing, and whether to prompt for the insertion of a flag.

Procedures: Configure the Appearance of Lines

To set up line arrow behavior

In project setup navigate to the class you want to modify. Locate and select the line you want to modify.

1. Select the line style you want to modify the line arrow behavior for (for example: Primary).
2. Under Line, click Edit Line.
3. In the Line Settings dialog box, under Symbol Properties, to the right of Flow Arrow Style, select a symbol from the list. Click OK.
4. Click OK.

To add a flow arrow

In project setup navigate to P&ID Class Definitions > Non Engineering Items > Flow Arrow.

1. Click Add Symbol.
2. In the Symbol Settings dialog box, Symbol Properties, locate and click Symbol Name. Enter new name for the symbol.
3. Under Symbol Properties, locate and click Block. Click the [...] button that is displayed at the end of the field.
4. In the Select Block Drawing dialog box, browse to and select the drawing that contains the block you want to use. Click Open

   NOTE You cannot use a drawing file as a block for the symbol; the block you want to use must be in the drawing file that you select.
5. In the Select Block dialog box, select a block from the Available Blocks list and then click OK.
6. In the Symbol Settings dialog box, change the properties under General Styles Properties and Other Properties as needed.
7. In the Project Details pane, under Symbol, click Add Symbol.
8. Under P&ID Class Definitions, click the plus sign (+) next to Engineering Items, Lines, and PipeLines or SignalLines to expand them.
9. Select the line style you want to change the flow arrow for (for example: Primary).
10. Under Line, click Edit Line.
11. In the Line Settings dialog box, under Symbol Properties, to the right of Flow Arrow Style, select a symbol from the list. Click OK.
12. In the Project Setup dialog box, under P&ID Class Definitions tree, click the plus sign (+) next to Engineering Items, Lines, and PipeLines or SignalLines to expand them.
13. Select the line style you want to modify the flow arrow behavior for (for example: Primary).
14. Under Line, click Edit Line.
15. In the Line Settings dialog box, under Symbol Properties, to the right of Flow Arrow Style, select a style from the list. Click OK.
16. Click OK.

To Create a line and add it to the tool palette

NOTE Before you start this procedure, make sure the P&ID tool palette is displayed.

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. In the Project Manager, tree view, right-click the project folder. Click Properties.
3. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
4. Under P&ID Class Definitions, click the plus sign (+) next to EngineeringItems and then expand Lines.
5. Right-click over PipeLines or SignalLines. Click New.
6. In the New Class Definition dialog box, enter a name for the new line definition.

NOTE Only the PipeLines and SignalLines nodes under P&ID Class Definitions support the creation of new line class definitions.

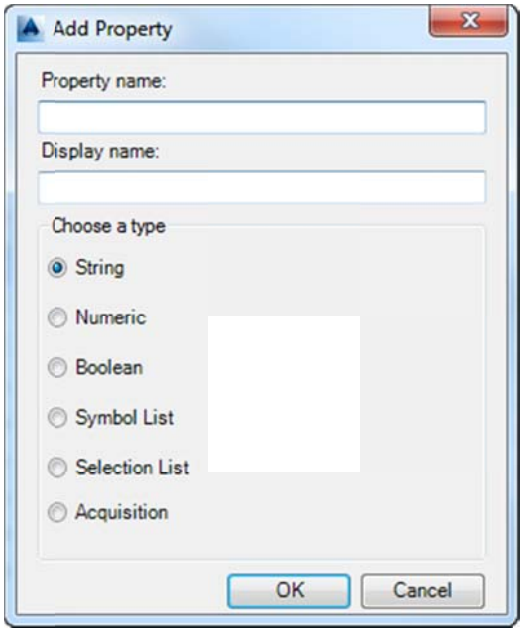
7. Click OK
8. Expand the node that the new line class definition was added to, and select it.
9. On the right pane, make the desired changes to the new line class definition's settings, properties, tag format, and annotation style.
10. Under Line, click Add to Tool Palette.
    The new line class definition is added to the active tool palette. It can be used just like the default tools provided with AutoCAD P&ID, and will be included in reports.
    NOTE If the tool palette is not open when you click Create Tool, the component is still added to the bottom of the last-active tool palette.
11. Click OK.

Procedures: Set Up Properties

To add a property to a class definition

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. In the Project Manager, tree view, right-click the project folder. Click Properties.
3. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
4. Under P&ID Class Definitions, locate and select the component or line class definition you want to add a property to.
5. On the right pane, under Properties, click Add.
6. In the Add Property dialog box, do the following:

   Under Property Name, enter a name for the new property. The name cannot contain any spaces.



- Below Display Name, enter the name you want to be displayed for the new property when using the Data Manager or Properties palette.
- Under Choose a Type, select one of the available data types.

7. Click OK. If you selected Selection List or Symbol List, the appropriate dialog box is displayed to let you create either a selection or symbol list.
   If you selected Acquisition, the Select Data Source dialog box is displayed to let you select the source from which the property value is to be acquired.
8. Click OK.

To modify a property for a class definition

1. 1 If the Project Manager is not already displayed, click Tools menu ➢ Palettes ➢ Project Manager.
2. 2 In the Project Manager, tree view, right-click the project folder. Click Properties.
3. 3 In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
4. 4 Under P&ID Class Definitions, locate and select the component or line class definition you want to edit a property for.
5. 5 On the right pane, under Properties, locate and select the property you want to edit and then do one of the following:

- Under Property Description, click the field and enter a new description.
- Under Default Value, click the field and enter a new value or in the drop-down list, select one from the available list. If the default value is Acquisition, in the drop-down list, select an appropriate item.
- If the property is of the List property type, click Edit to change the selection or symbol list that is assigned to the property.
- Under Acquisition, click the [...] button and select Add acquisition rule. In the Select Data Source dialog box, select the source where the property value is acquired.

NOTE If you want to change the name of the property or its type, delete the property and then add it again.

6. Click OK.

To delete a property from a class definition

1. If the Project Manager is not already displayed, click Tools menu ➢ Palettes ➢ Project Manager.
2. In the Project Manager, tree view, right-click the project folder. Click Properties.
3. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
4. Under P&ID Class Definitions, locate and select the component or line class definition you want to edit a property for.
5. On the right pane, under Properties, locate and select the property you want to delete. Click Remove.

6. In the Confirm Delete message box, click Yes.
7. Click OK.

Set Up Property Acquisition

When you select acquisition as a property type, you set up a rule stating that the property acquires its value from another property. The acquisition source can be another class, project, or drawing property.

Acquisition ensures consistency among component property values. If the source value changes, all components set to acquire that value change as well.

Property acquisition is also useful for maintaining consistent tagging. When you change a source value, tag formats that are based on acquired properties update automatically throughout the project.

Understand Property Acquisition Rules

You can select any drawing or project property without restriction as the source of an acquisition rule. When you select a class property as the source, however, make sure that the acquiring class and the source class are connected.

A valve may acquire a size value from a line, for example, because the two are connected in a relationship. A tank and a furnace, however, have no direct link and no one-to-one relationship between them. Therefore, you cannot set up an acquisition rule between them.

You can set up property acquisition rules when the following one-to-one component relationships exist:

- Line and inline asset
- Line and start asset
- Line and end asset
- Line and arrow
- Annotated and annotation
- Line and break
- Line and page connector
- Line and nozzle
- Pipe line group and pipe line
- Signal line group and signal line
- Connector and connector
- Asset and non-engineering (only between a control valve and its actuator)

The following properties have acquisition rules set by default; you can view them when you create a new project:

Acquisition Property	Source Property
HandValves.Size	PipeLines.Size
HandValves.Spec	PipeLines.Spec
InLineInstruments.Size	PipeLines.Size
PipingSpecialtyItems.Size	PipeLines.Size
PipingSpecialtyItems.Spec	PipeLines.Spec
PipingFittings.Size	PipeLines.Size
PipeFittings.Spec	PipeLines.Spec

Understand Acquire Mode and Override Mode

A property that is set to acquire its value from another property is in Acquire mode. However, you can switch this property into Override mode and edit the value manually. Once a property is in Override mode,

its value is no longer acquired from another source.

The icon next to the property indicates whether the property is in Override or Acquire mode. The icons appear in the Properties Palette, the Data Manager, and the Assign Tag dialog box. When the Override icon is visible, the value is editable.

-  The property is in Acquire mode.
-  The property is in Override mode

Understand Initialization Only

You select Acquiring (the default) to set up a property to acquire its value from another property. Alternately, you can select Initialization Only, which permits the acquisition to occur only once, when the component is first initialized.

After initialization, the property moves immediately into Override mode. In Override mode, you can edit the value manually because it is no longer acquired from another source.

Copy or Move Components with Acquired Properties Between Pipelines

When you set up a component property to acquire its value from another property (for example, a valve size acquiring from the line size) and then copy or move that valve onto another line, the valve acquires the property value from the new line. However, if the valve property you are moving is in override mode, the specific value accompanies the valve.

Understand Acquisition from Multiple Sources

Many Acquisition relationships are simple one-to-one relationships. For example, a gate valve has a one-to-one relationship with a pipe line and acquires its size and spec from that line.

However, a component can have multiple acquisition sources. If sources have identical values or some identical values along with others that are unspecified, a value can be acquired. Only when the sources have conflicting values is the acquisition impossible. A question mark is displayed in place of the acquired value.

For example, a three-way valve has a direct relationship with three different pipe line segments. In such cases, as long as the different sources either have the same spec value (for example: *PVC*) or the same value in combination with blank values, the valve acquires the value. If the pipe line segments have different specs, a question mark is displayed in the valve's Spec field.

Understand Acquisition Between Signal Line Groups and Pipe Line Groups

By associating a signal line group with a pipe line group, you can set up the signal line group to acquire any of that pipe line group's properties. You must manually associate the groups using SLGROUPEDIT.

Although a pipe line group can be associated with many signal line groups, a signal line group can be associated with only one pipe line group. Once an association is established, the following capabilities are available:

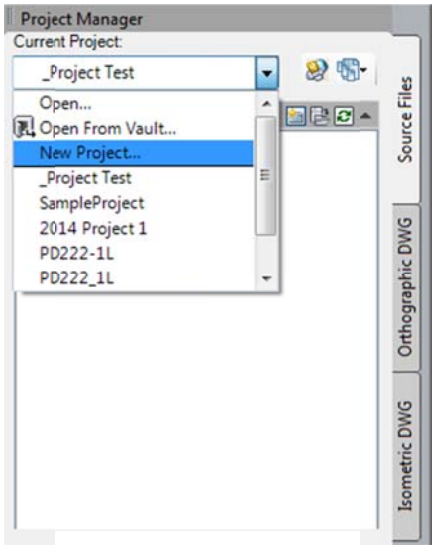
- The signal line group can acquire properties from the pipe line group.
- Signal lines can then acquire these properties from their signal line group.
- Components (such as general instruments) on the signal line can then acquire these properties from the signal lines.

NOTE Association and dissociation are manual processes. If you make changes to a drawing that makes a current association inappropriate, you can change the association. As you make changes, all acquired properties are updated to reflect the current association. Tags and annotations based on these properties are also updated automatically.

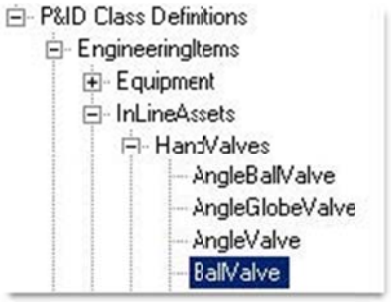
Procedures: Set Up Property Acquisition

To view an existing property acquisition rule

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.

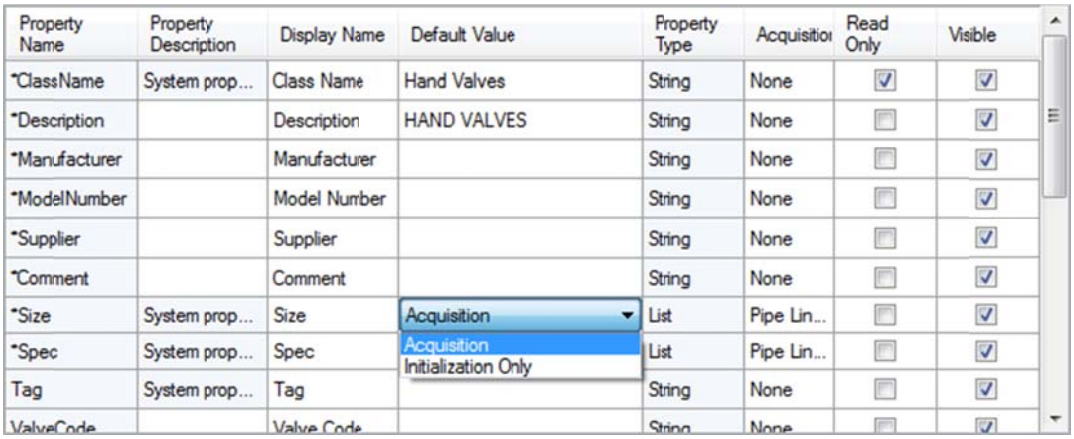


3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select the class definition whose property acquisition rule you want to create (for example: *Engineering Items* ➤ *Inline Assets* ➤ *Hand Valves*).



In the Properties group, find the Size property and note that under default Value, you can choose either Acquisition or Initialization Only from the dropdown list.

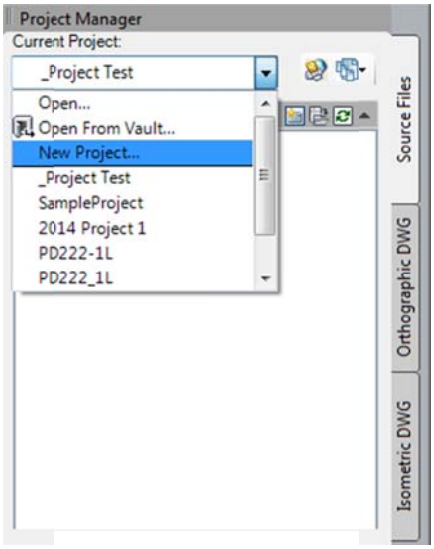
Under Acquisition, you can see that this valve's size is inherited from PipeLines.Size. If PipeLines.Size has a value of 3, that value appears in the Data Manager for this valve as well.



6. Close the Project Setup dialog box.

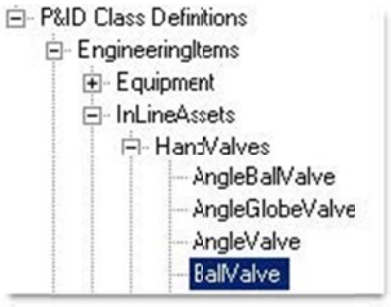
To set up a new property acquisition rule

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.

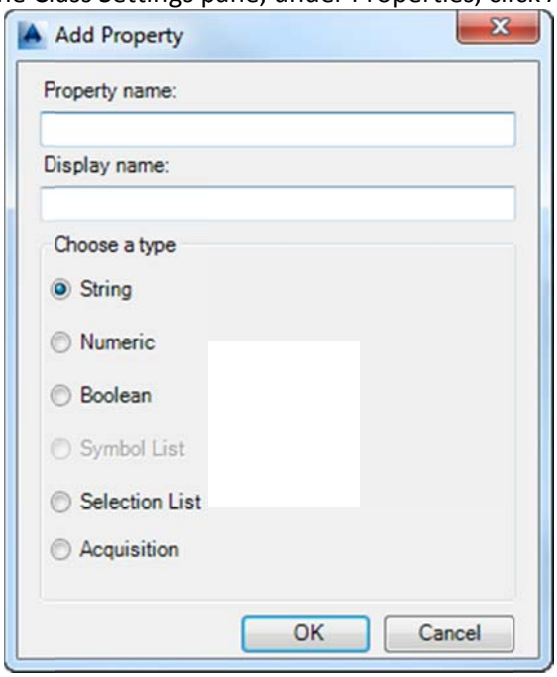


3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.

5. Continue to expand the list until you locate and select the class definition whose property acquisition rule you want to create (for example: *Engineering Items* ➤ *Inline Assets* ➤ *Hand Valves*).

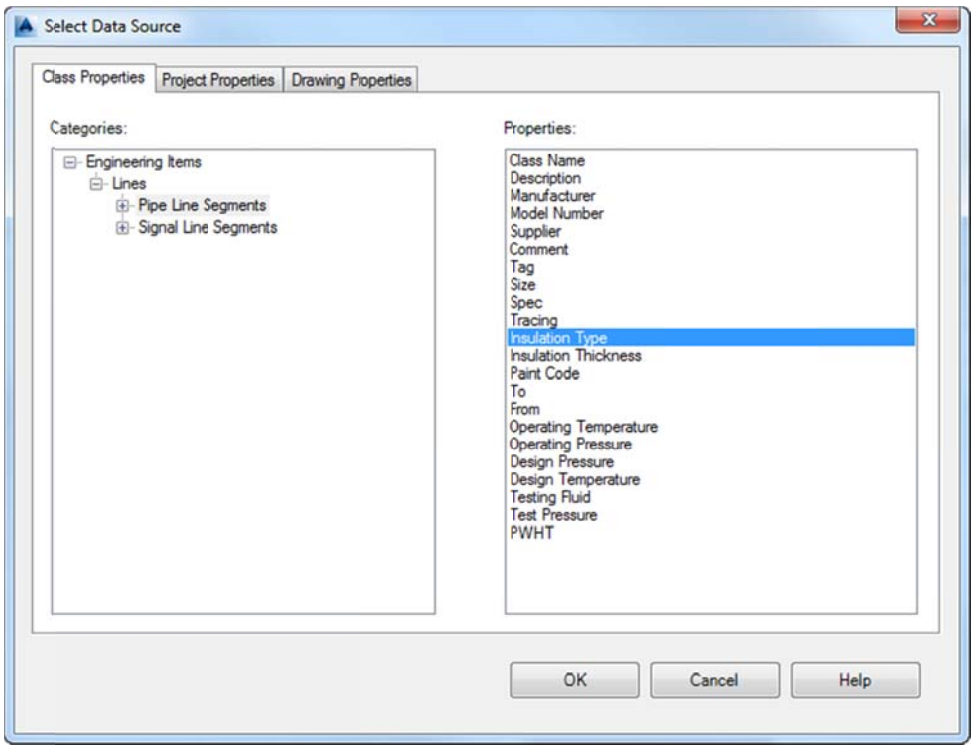


In the Class Settings pane, under Properties, click Add.



In the Add Property dialog box, do the following:

- Under Property Name, enter the property name (for example: *PipelinesInsulationType*).
- Under Display Name, enter the new property name you want displayed in the Data Manager or the Properties palette (for example: *PipelinesInsulationType*).
- Under Choose a Type, select Acquisition. Click OK.

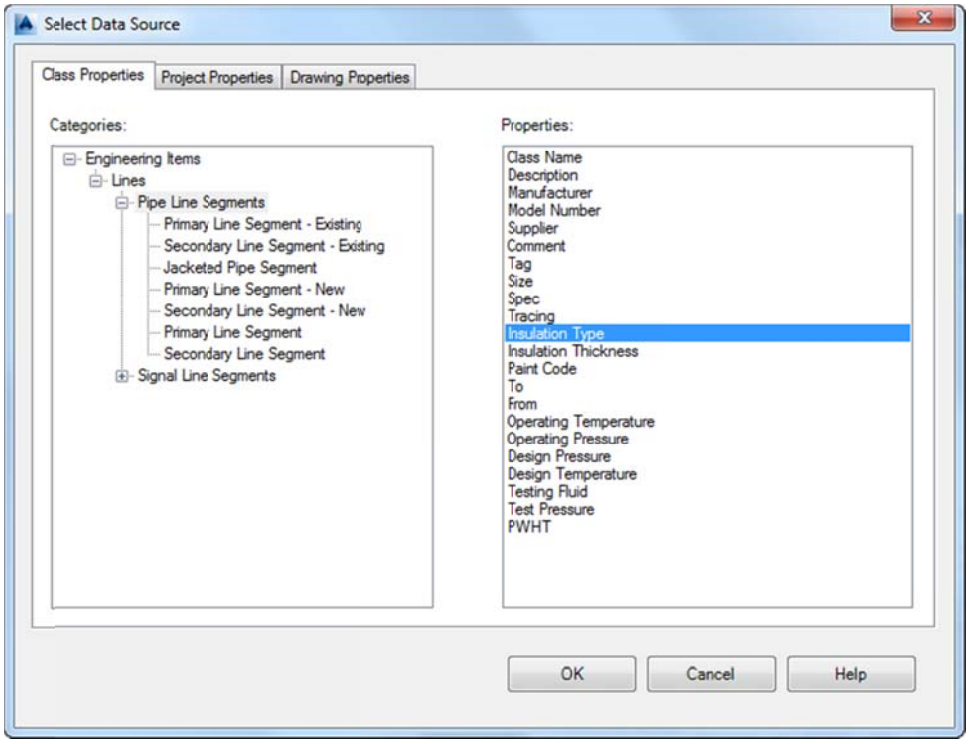


6. In the Select Data Source dialog box, Class Properties tab, do the following:
   a. Under Categories, click the plus sign (+) next to Engineering Items to expand the list. Continue to expand the list until you locate and select an item (for example: *Pipe Line Segments*).
   b. Under Properties, select a property (for example: *Insulation Type*). Click OK.
7. In the Project Setup dialog box, click OK.

To add an acquisition rule for an existing property

1. Go to Project Setup, and expand P&ID Class Definitions.

2. Continue to expand the list until you locate and select the class that should contain the acquisition property you want to add.

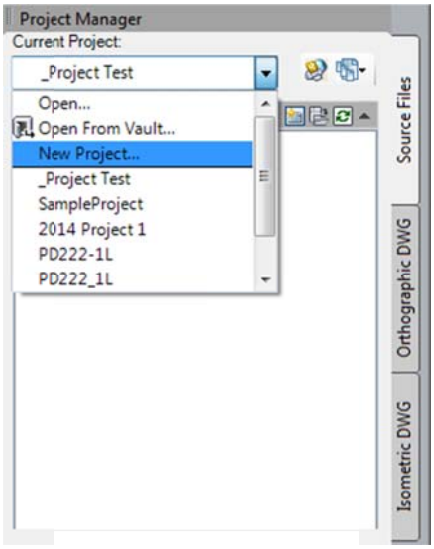


3. In the Select Data Source dialog box, Class Properties tab, do the following:

   - Under Categories, click the plus sign (+) next to Engineering Items to expand the list. Continue to expand the list until you locate and select an item (for example: *Engineering Items* ➤ *Lines* ➤ *Pipe Line Segments*).
   - Under Properties, select a property (for example: *Insulation Type*). Click OK. 9 In the Project Setup dialog box, click OK.

To edit an acquisition rule for a property

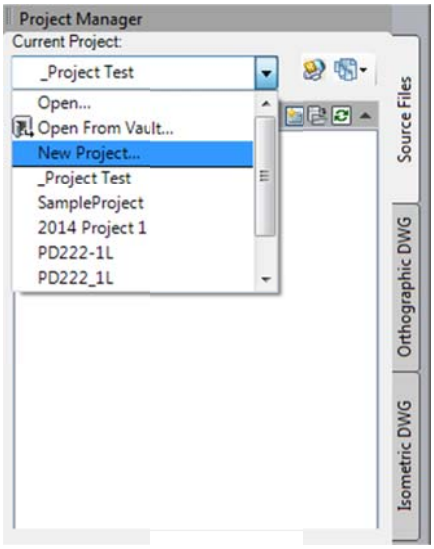
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.



3. In the Project Manager, right-click the project. Click Properties.
4. In the Project Setup dialog box, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select the class whose property you want to change (for example: *Engineering Items* ➢ *Equipment*).
6. On the Class Settings pane, Under Properties, locate the property whose acquisition rule you want to edit.
7. In the Acquisition column, click in the box, and then click the [...] button. Select Add Acquisition Rule.
8. In the Select Data Source dialog box, Class Properties tab, do the following:
    a. Under Categories, click the plus sign (+) next to Engineering Items to expand the list. Continue to expand the list until you locate and select an item (for example: *Engineering Items* ➢ *Lines* ➢ *Pipe Line Segments*).
    b. Under Properties, select a property (for example: *Insulation Type*). Click OK. 9 In the Project Setup dialog box, click OK.

To remove an acquisition rule from a property

1. If the Project Manager is not already displayed, click Tools menu ➢ Palettes ➢ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, right-click the project. Click Properties.
4. In the Project Setup dialog box, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select the class whose property you want to change (for example: *Engineering Items* ➢ *Equipment*).
6. On the Class Settings pane, Under Properties, locate the property whose acquisition rule you want to remove.
7. In the Acquisition column, click in the box, and then click the [...] button. Select Remove Acquisition Rule.
8. In the Project Setup dialog box, click OK.

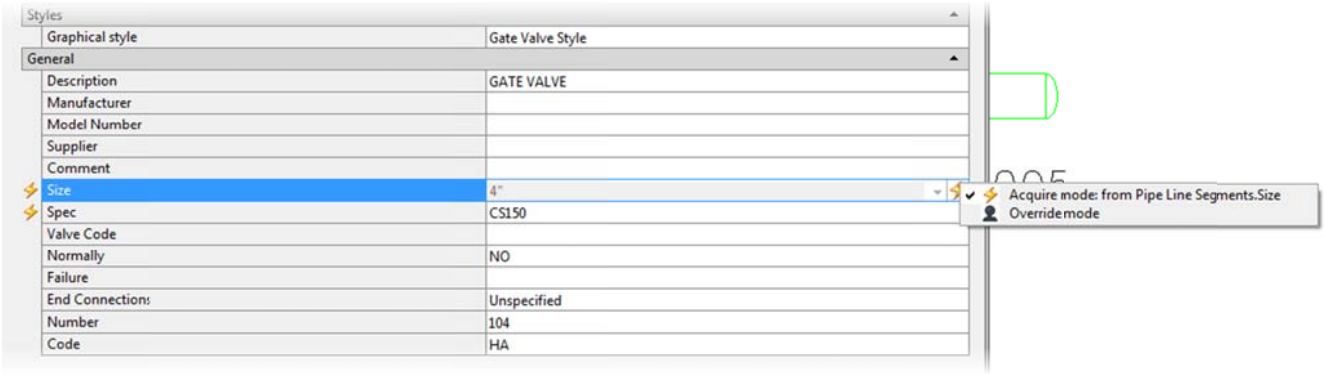


To override an acquisition property

You can override an acquisition property using the Data Manager or the Properties palette. The following steps describe overriding an acquisition property using the Properties palette.

1. In a drawing, right-click the component whose acquisition rule you want to override. Click Properties.
2. In the Properties palette, locate the property you want to change. Click the field in the right column.
3. Click Acquire Mode

   . In the flyout menu, select Override Mode.

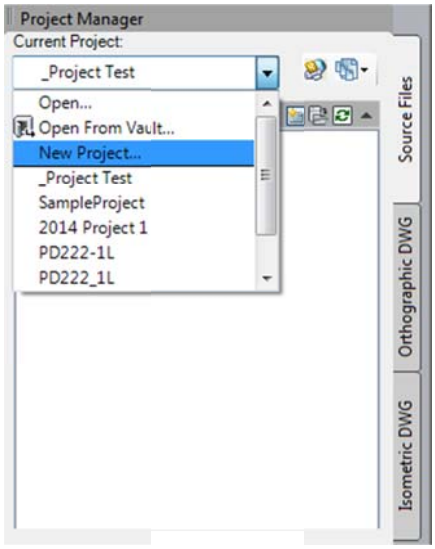


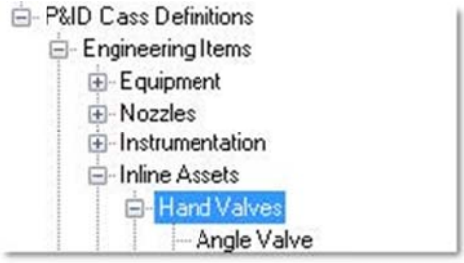
4. Enter a new value.
5. Close the Properties Palette.

NOTE When you export data from the Data Manager to a Microsoft Excel spreadsheet, you can change the values of properties that are in Acquire mode in Excel. When you import the file into the Data Manager and accept the changes, the new values are displayed and the properties are automatically changed to Override mode.

To change how an existing property acquisition rule is applied

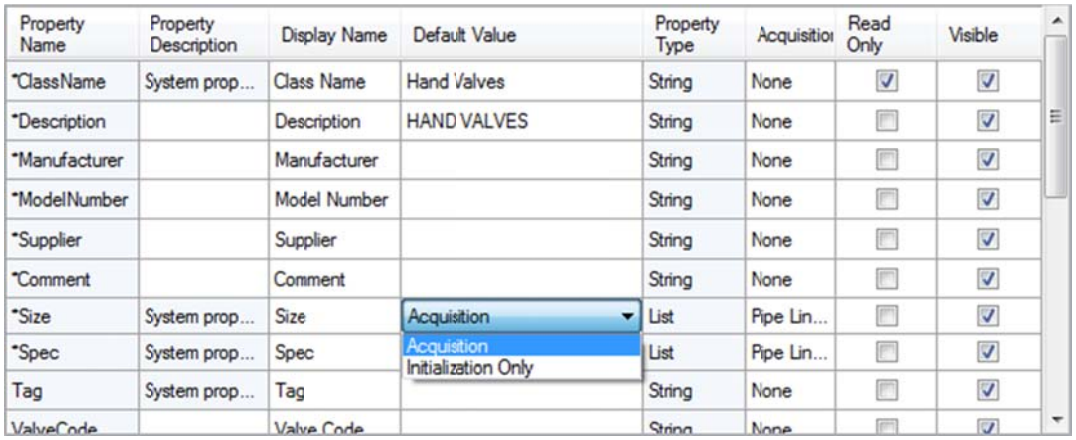
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, right-click the project. Click Properties.
4. In the Project Setup dialog box, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select the class whose property you want to change (for example: *Engineering Items* ➤ *Inline Assets* ➤ *Hand Valves*).





6. On the Class Settings pane, under Properties, locate the Property Name column, Size property. In the Size row, in the Default Value drop-down list, do either of the following:
    a. To set the property so that it always acquires its value from *PipeLines.Size*, select Acquisition (the default).
    b. To set the property so that its value is acquired once (when a valve is first initialized), select Initialization Only.

NOTE After initialization, a valve's property value changes to Override mode. Users can edit the property value.



In the Acquisition column, the valve size is displayed as acquired from *PipeLines.Size*. If *PipeLines.Size* has a value of 3, that value appears in the Data Manager for this valve.

7. In the Project Setup dialog box, click OK.

Set Up Selection and Symbol Lists

Selection and symbol lists are used to control a list of predefined selections of choices. These lists are useful for helping to enforce standard sizes for items such as piping specs, piping sizes, and instrument types, or when you want designers to select from a predefined set of options.

AutoCAD P&ID provides a set of selection lists. You can add your own items or delete items that don't apply to your environment. Drafters can also enter their own values in the lists in the Data Manager.

As part of your project setup tasks, you can set up new selection lists or change the values of an existing one.

The selection lists you create or modify populate the P&ID Class Definitions data in the Project Setup dialog box, where you define the properties of Engineering Items, Non-Engineering Items, Pipe Line Groups, or Signal Line Groups. Those properties then are included in the component or line behavior when it is placed from the tool palette onto a drawing.

Be sure to visit the Plant 3D store and check for plugins that aid selection list customization.

http://apps.exchange.autodesk.com/PLNT3D/en/List/Search?query=selection+lists

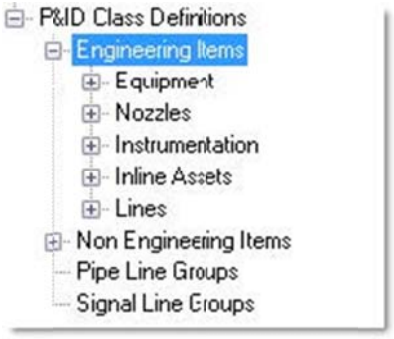
Understand Symbol Lists

Symbol lists are similar to selection lists in that you designate a value for a property. But with a symbol list, you also define the symbol to display for a component in a P&ID drawing. The symbols that you can select for a symbol list have been assigned to the current class definition or inherited from a class definition family.

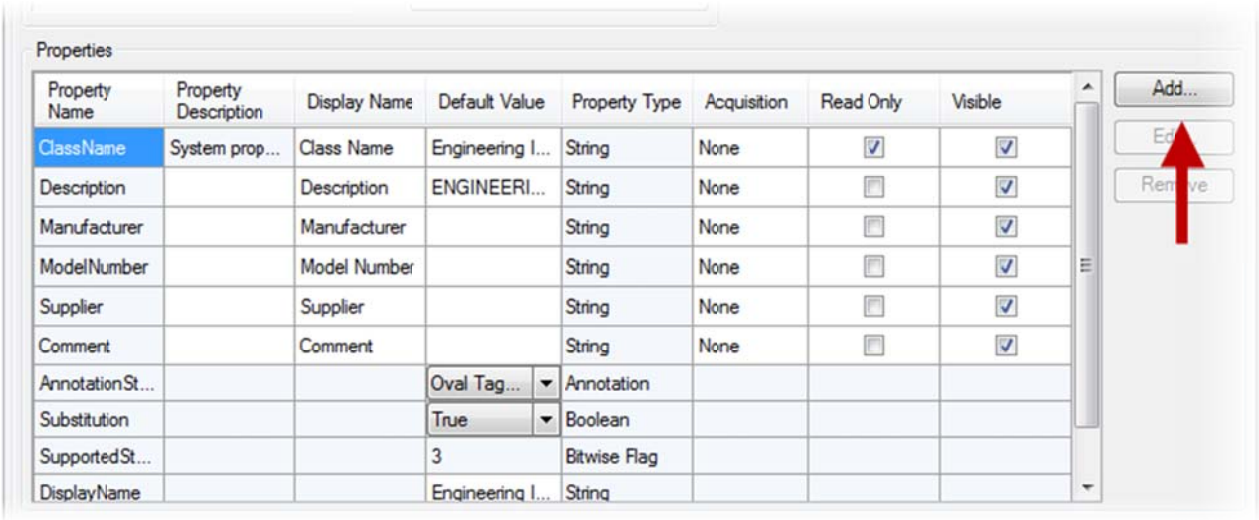
Procedures: Set Up Selection and Symbol Lists

To create a selection list

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



6. In the Properties group, click Add.

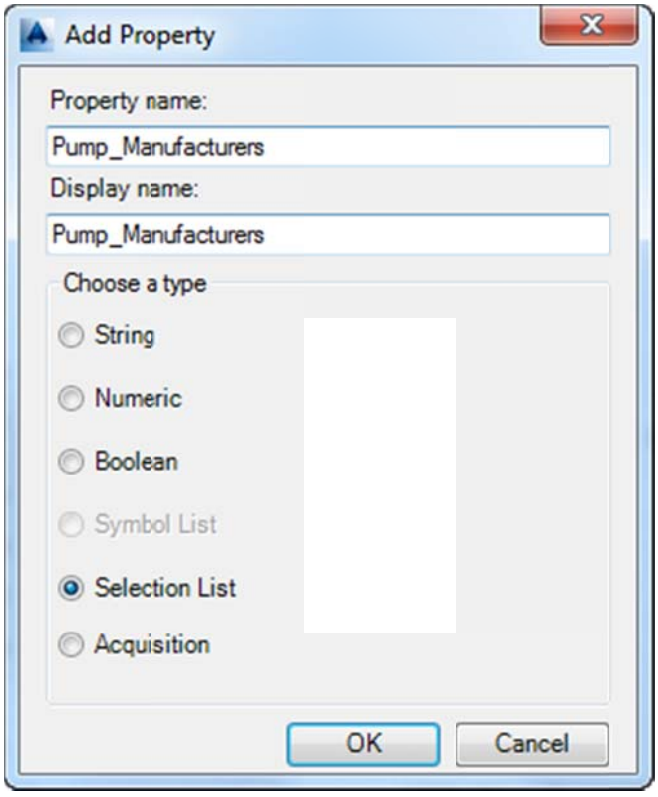


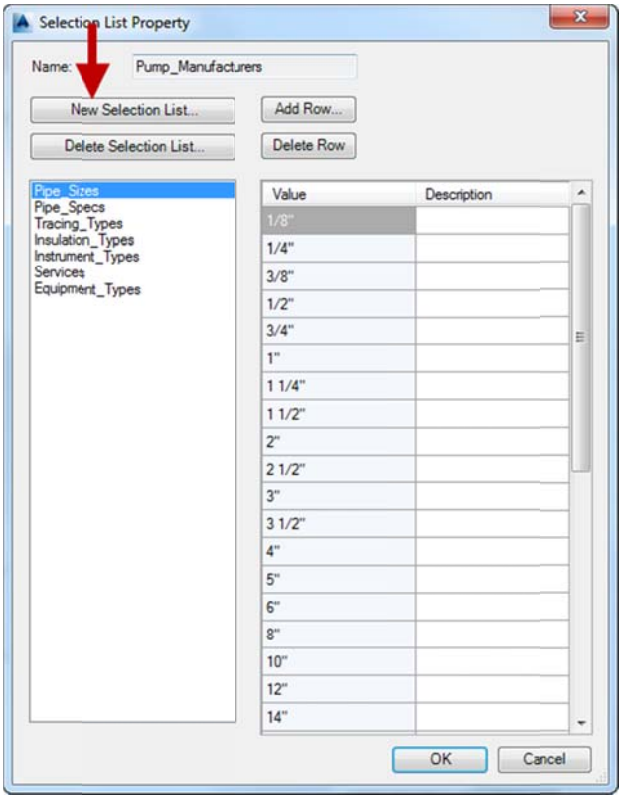
7. In the Add Property dialog box, do the following;

   Under Type, select Selection List.

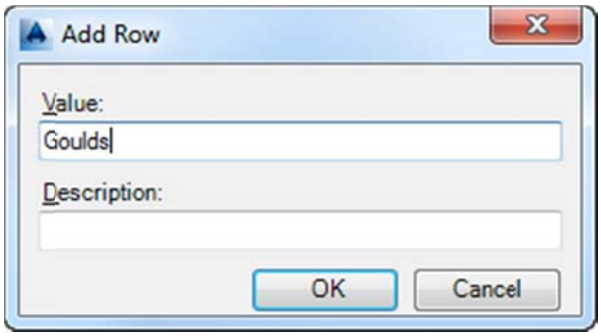
   Below Property Name, enter a name for the new property (for example: *Pump_Manufacturers*). The name cannot contain any spaces.

Below Display Name, enter the name you want to be displayed for the new property when using Data Manager or Properties palette (for example: *Pump Manufacturers*).





8. Click OK.
9. In the Selection List Property dialog box, click New Selection List.
10. In the Add Selection List dialog box, enter the name for the new selection list (for example: M*anufacturers*). Click OK.
11. In the Selection List Property dialog box, click Add Row.

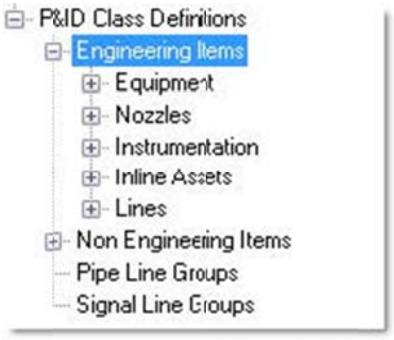


12. In the Add Row dialog box, enter the new value (for example: *Goulds*) and a description of the value, if necessary.

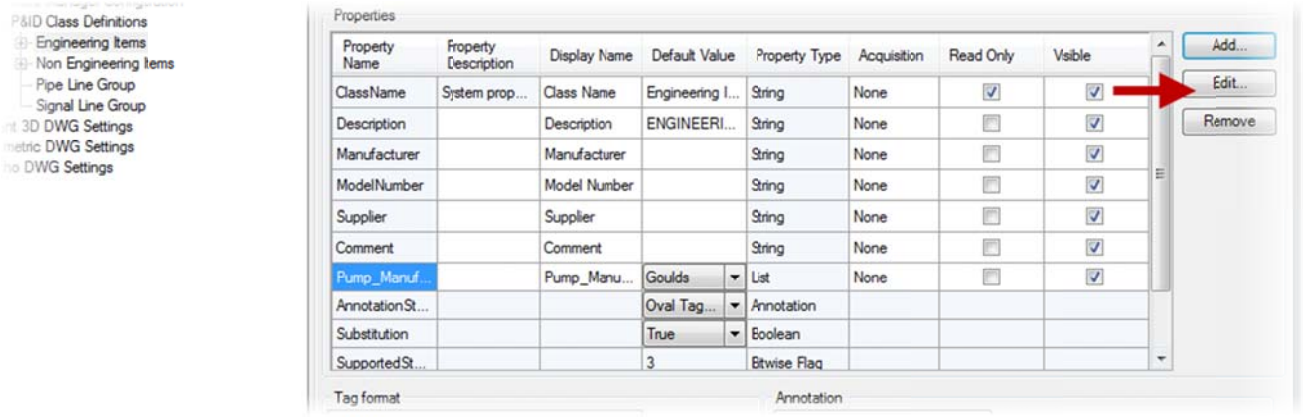
13. Continue adding rows until the selection list is complete.
14. Click OK.
15. On the Class Settings pane, under Properties, the selection list is displayed for the selected class definition. The value displayed in the list is the default value for that component.

To modify or delete items in a selection list

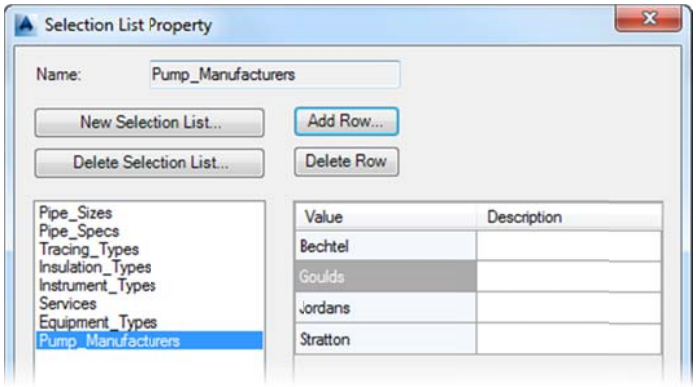
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



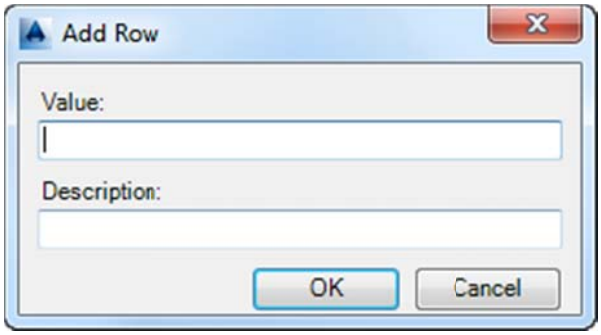
6. On the Class Settings pane, under Properties, Property Name, select the property containing the selection list you want to modify. Click Edit.



7. In the Selection List Property dialog box, click the property whose data you want to change (for example: *Manufacturers*).



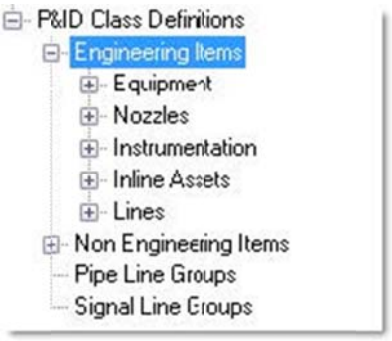
8. Click Add Row.



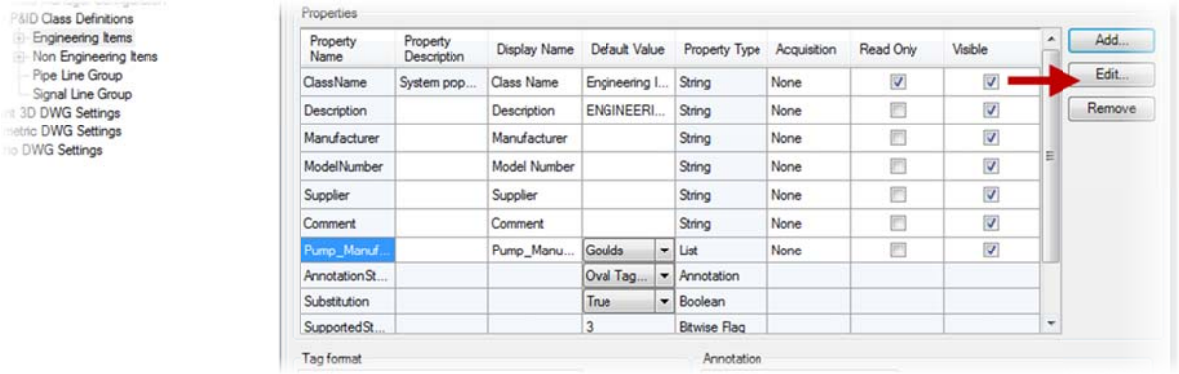
9. In the Add Row dialog box, enter the new value and a description of the new selection list entry (for example: *Bechtel*). Click OK. In the Selection List Property dialog box, under Value, the new selection list entry is added.
10. In the Selection List Property dialog box, select a value (for example: *Goulds*). Click Delete Row.
11. In the Confirm Delete message, click Yes.
12. Click OK to close each dialog box.

To delete a selection list

1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



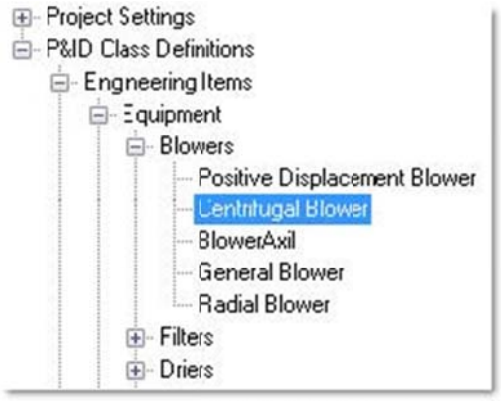
6. On the Class Settings pane, under Properties, select the property you want to delete. Click Edit.



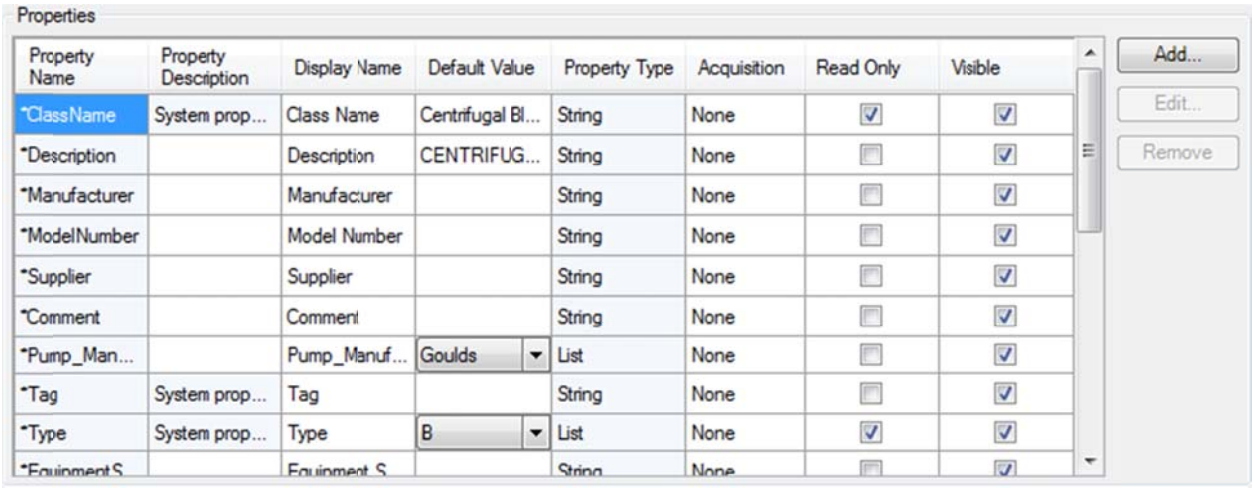
7. In the Selection List Property dialog box, under Selection List, click the selection list you want to remove (for example: *Manufacturers*).
8. Click Delete Selection List.
9. In the Confirm Delete message, click Yes.
10. Select another selection list to assign to the current property.
11. Click OK.

To create a symbol list

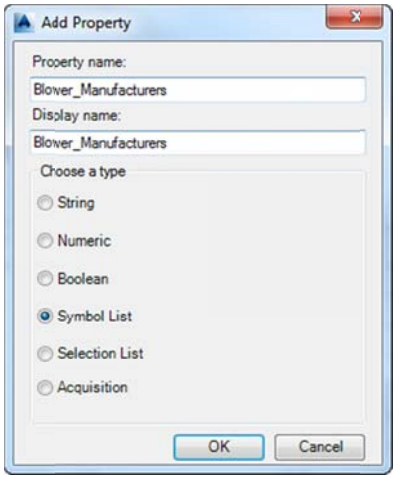
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



6. On the Class Settings pane, under Properties, click Add.



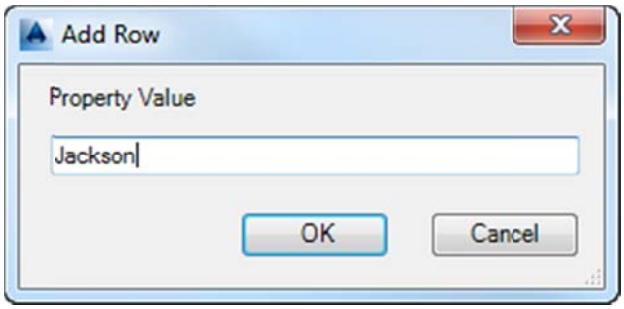
7. In the Add Property dialog box, do the following:



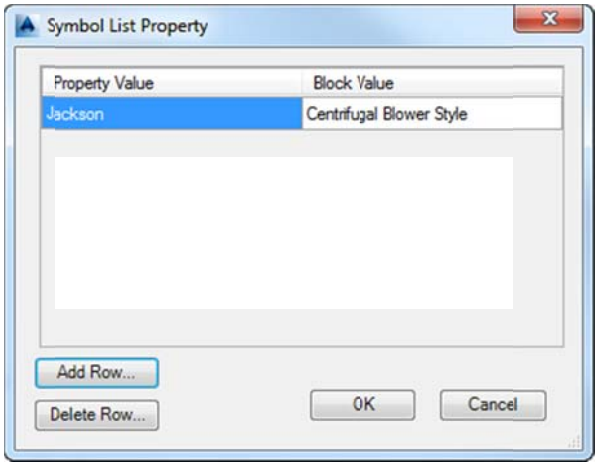
- Click Symbol List.
- Specify a property name for the component or line (for example: *Blower_Manufacturers*).
- Specify a display name for the component or line (for example: *Blower Manufacturers*).
- Click OK.

NOTE To create a property that uses a symbol list, you must assign more than one symbol to the component's class definition.

8. In the Symbol List Property dialog box, click Add Row.



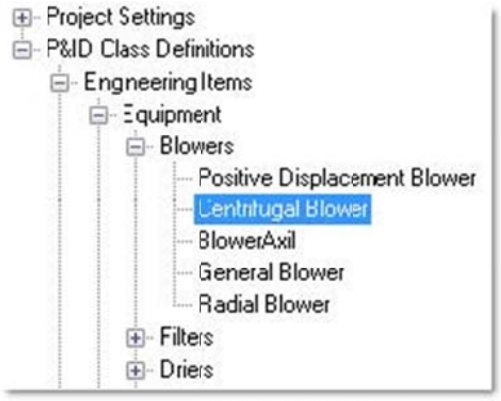
9. In the Add Row dialog box, under Property Value, enter the name of the new symbol list entry for example: *Jackson*). Click OK.



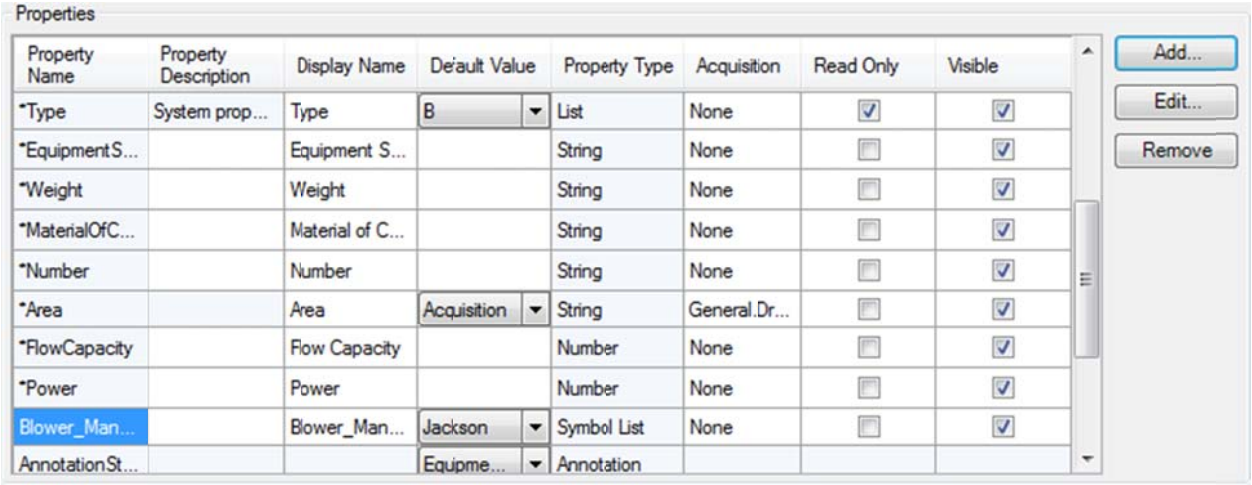
10. In the Symbol List Property dialog box, under Property Value, click the new entry. Under Block Value, in the drop-down list, select a symbol to assign to the property value.
11. Continue adding rows until the symbol list is complete.
12. Click OK.

To modify or delete items in a symbol list

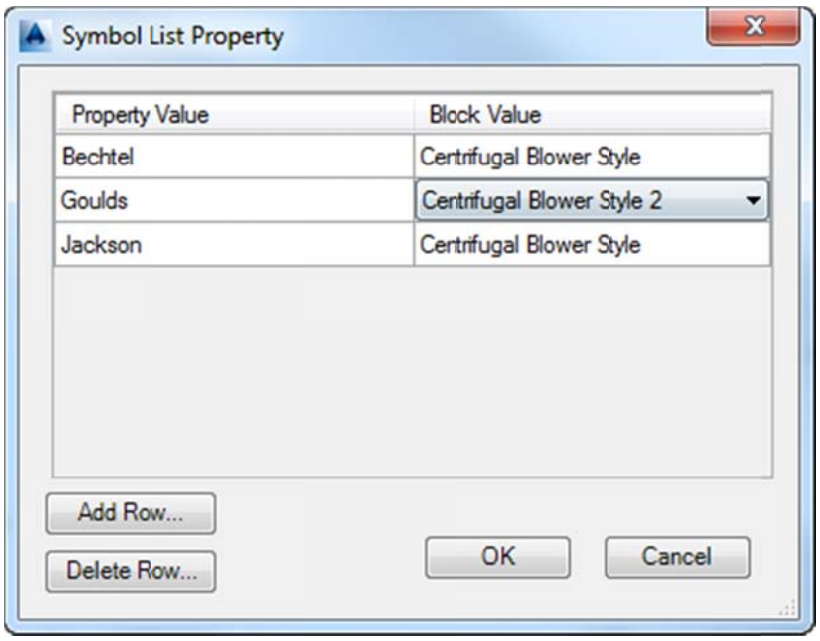
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



6. On the Class Settings pane, under Properties, select the property containing the symbol list that you want to modify. Click Edit.



7. In the Symbol List Property dialog box, click Add Row.
8. In the Add Row dialog box, enter a value for the new symbol list entry(for example: *Bechtel*). Click OK.



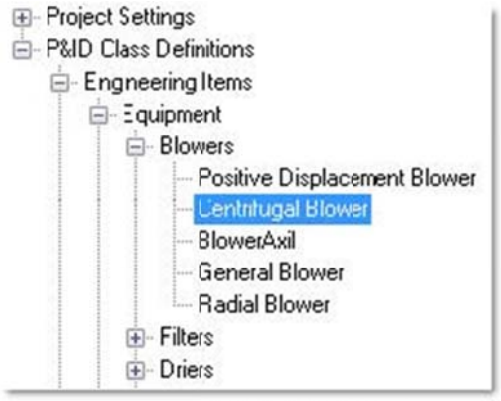
The new symbol list entry is added to the selection list for the selected property.

NOTE If you want to change the property value for an entry, delete the original entry and add a new entry with a new value.

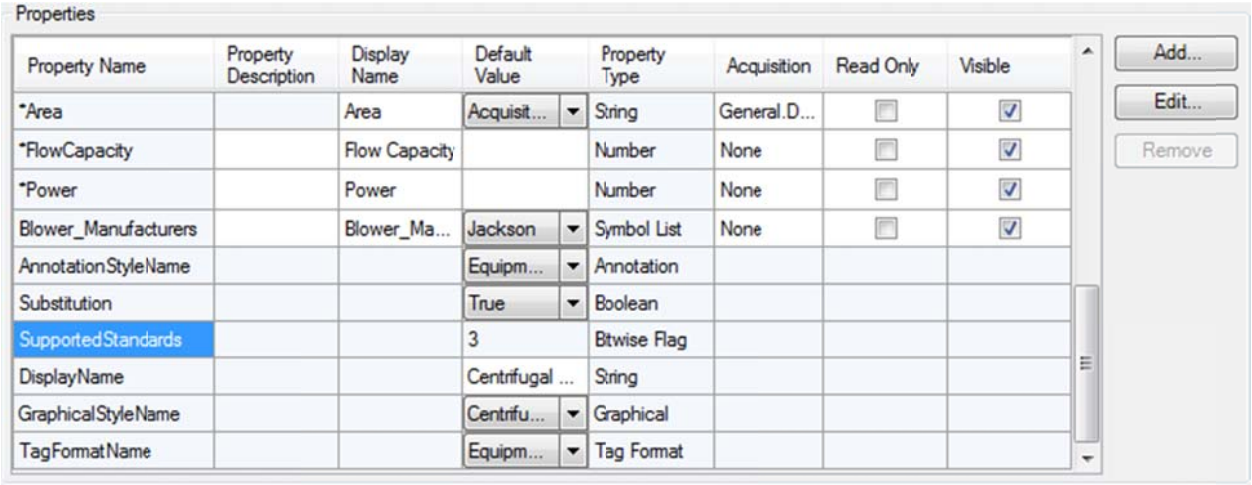
9. In the Symbol List Property dialog box, select the new symbol list entry. Under Block Value, double-click and select the block style.
10. To delete an entry, select the entry (for example: *Bechtel*) and click Delete Row.
    NOTE If you delete a value that is currently assigned to a component in a P&ID drawing, the value is removed from the symbol list, and any component using that value is assigned no value; the symbol assigned to the block remains to maintain visual fidelity.
11. Click OK to close each dialog box.

To modify the Standards that Support a Class Definition

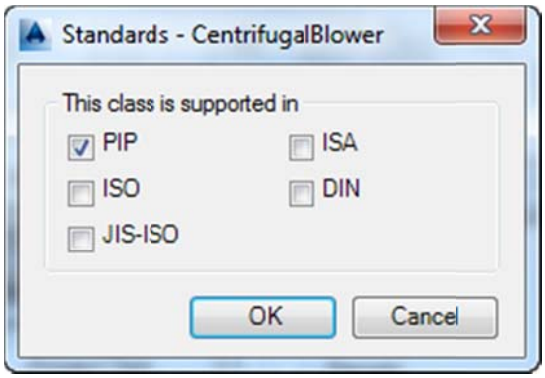
1. If the Project Manager is not already displayed, click Tools menu ➤ Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand the list.
5. Continue to expand the list until you locate and select a component or line class definition (for example: *Engineering Items*).



6. On the Class Settings pane, under Properties, scroll down the list and select the SupportedStandards property name.



7. Click Edit.
8. In the Standards dialog box, select which standards support the selected class. Click OK.



OffPage Connectors

Off-page connectors create a continuance of a line from one project drawing to another. You can use an existing off-page connector to create a new one.

You can change the following styles for off-page connectors:

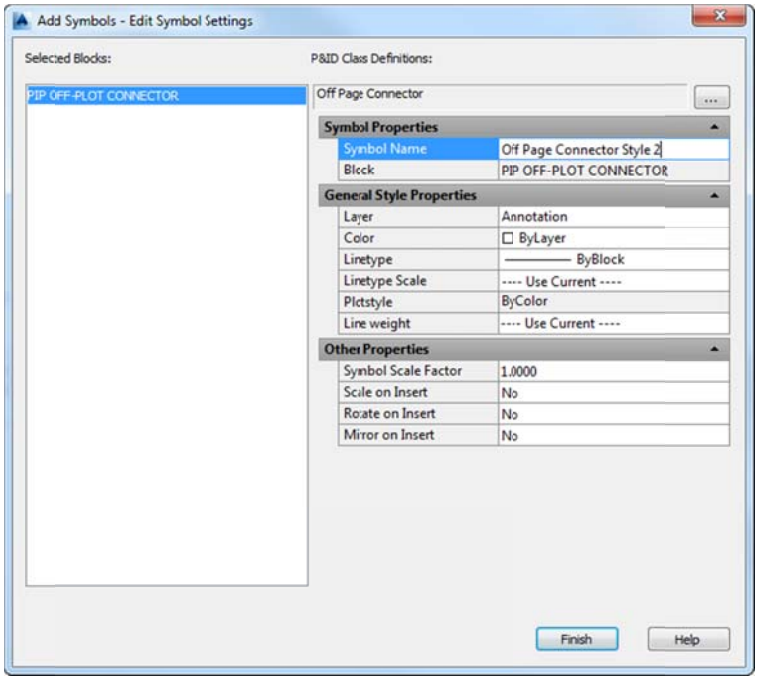
- **Symbol properties.** Sets the name of the symbol and defines the block for the connector when it is inserted into a drawing.
- **General style properties.** Sets layer, color, linetype, linetype scale, plot style, and lineweight.
- **Other properties.** Sets the symbol scale and whether an off-page connector is scaled, rotated, and mirrored when it is inserted in a drawing.

Procedures: Set Up OffPage Connectors

To create an offpage connector and add it to the tool palette

NOTE Before you start this procedure, make sure the P&ID tool palette is displayed in your drawing and that the active tool palette tab is the one where you want to add the new component.

1. If the Project Manager is not already displayed, click Tools menu Palettes ➤ Project Manager.
2. If the correct project is not already open, open it now.
3. In the Project Manager, tree view, right-click the project folder. Click Properties.
4. In the Project Setup dialog box, Project Settings, click the plus sign (+) next to P&ID Class Definitions to expand it.
5. Continue to expand the tree until you find the off-page connector (*NonEngineeringItems* ➤ *Connectors* ➤ *OffPageConnector*) and select the OffPageConnector node.
6. Right-click Off Page Connector. Click New.
7. In the New Class Definition dialog box, enter a name for the new off-page connector.
8. Click OK.
9. Expand the OffPageConnector node, and select the new off-page connector.
10. On the right pane, under Symbol, click Edit Symbol.
11. In the Symbol Settings dialog box, change the items that make the new off-page connector unique (for example, you may want to change the description). Click OK.



12. Under Symbol, in the drop-down list, locate the style you just created (in this example, *OffPageConnectorStyle2*).
13. Click Add to Tool Palette. The new style is added to the active tool palette. It can be used just like the default tools provided with AutoCAD P&ID, and will be included in reports.
14. Click OK.

SQL Server

The decision to use SQL Server is driven by the number of users modifying project data at one time. The default database type, SQLite is valid for up to 2 TB per file, so the project file size is not the issue. Because the SQLite database is a single file, successful read/writes depend on fast access. When more users access the database at one time, they have a higher chance of hitting the database at the same time (or close enough).

Due to network configurations, server performance, computer performance, network loads, and a host of other factors, a precise number of users cannot be given. However, through experience with various clients, most people start to see performance degradation with between 6 - 10 users.

If you know you will have more than 10 active users, you should implement SQL Server Express or SQL Server.

You must also use SQL Server if you plan to use Plant 3D with Vault.

Database Types

SQL Server – An enterprise-level product offering from Microsoft that includes a database server with administration tools for replicating databases between sites, and other advanced features

SQL Server Express – A free product offering from Microsoft that includes a database server **without** advanced administration tools. You can still configure backups.

SQLite – An open source file-based database used by developers world-wide. The database engine is fast with good performance.

Versions

AutoCAD Plant 3D has been run with SQL Server 2005, SQL Server 2008, and SQL Server 2012.

Articles on setting up SQL Server Express and creating backups are available here:

http://www.pdoteam.com/series/plant3d-on-sql-express/

Vault

Autodesk Vault (http://www.autodesk.com/products/autodesk-vault-family/features) is document management software that integrates with many products in the Autodesk portfolio. In 2014, Vault became integrated into the Plant Project Manager.

Vault should be used in the following conditions:

- You have multiple sites that need to share data
- You can use SQL Server or SQL Server Express.

Vault allows you to store the drawing data in a central location, and have satellite offices check in/out drawings on an as-needed basis. Currently, all xrefs must reside within the project structure, as Plant uses its own working directory for Vaulted projects.

Americas Reseller Training

Appendices

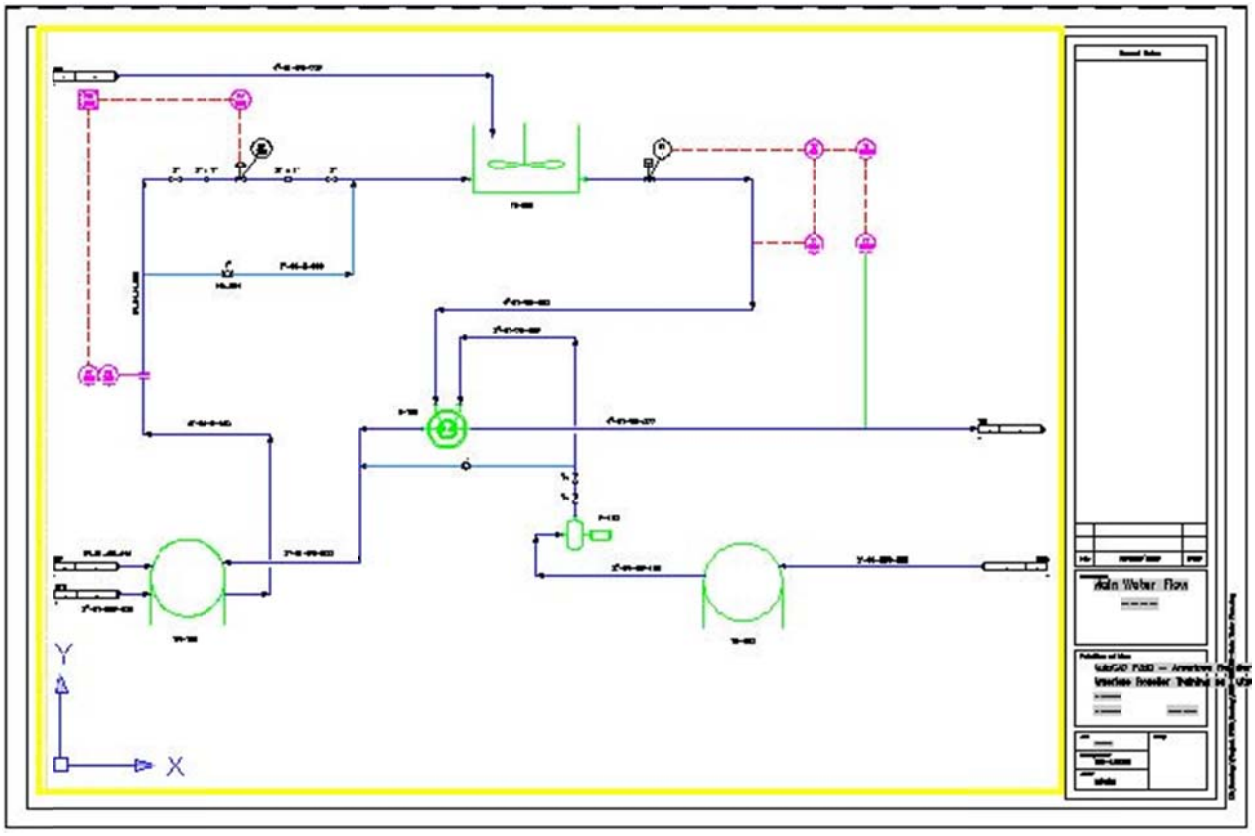
Autodesk

Appendix A Additional Exercises

Creating a P&ID drawing

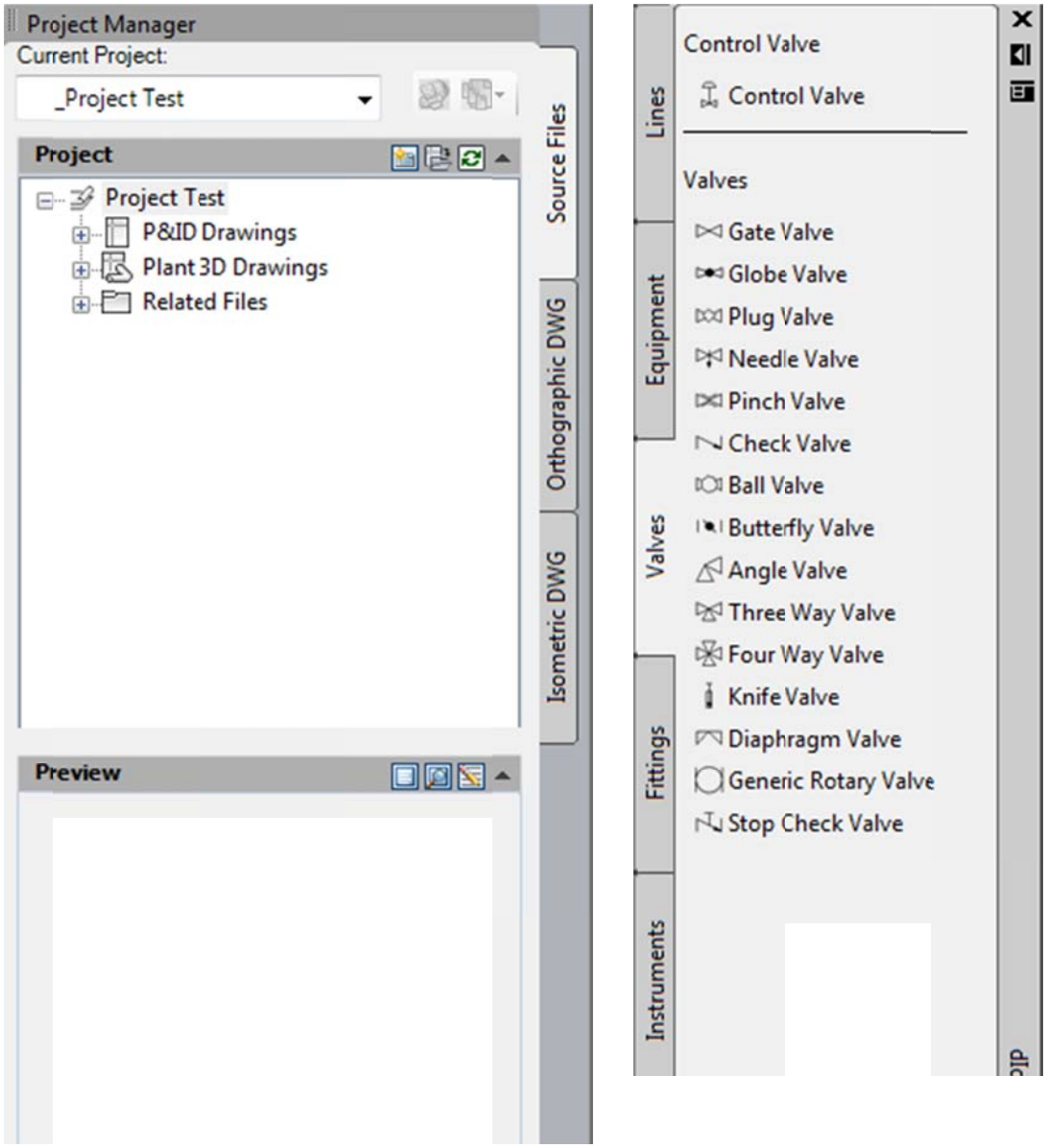
In this session we will create the P&ID shown below, to provide a general idea of how to use AutoCAD P&ID to create production P&IDs. In particular, we will cover these items in this order:

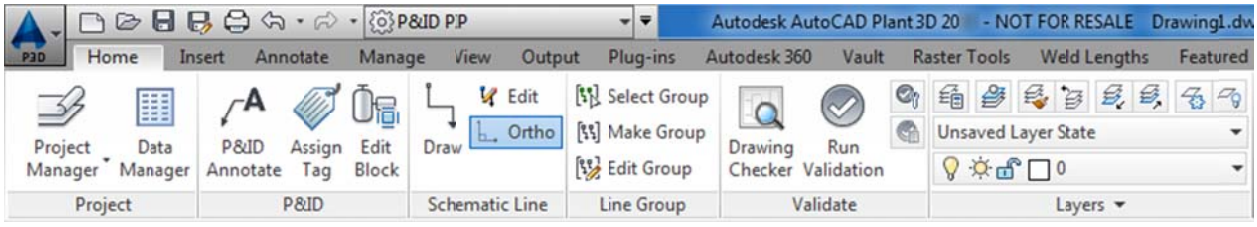
1. Drawing equipment & assigning tags
2. Connecting equipment with process lines
3. Placing hand valves, reducers and control valves
4. Placing instrumentation
5. Entering equipment data and placing equipment annotations
6. Entering pipeline data and placing pipeline annotations
7. Placing off page connectors.



Launching AutoCAD P&ID

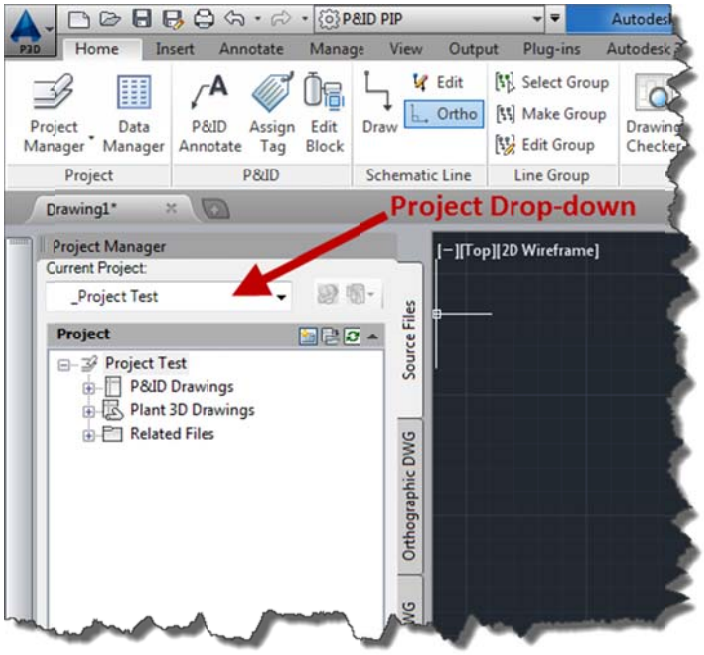
As with other AutoCAD based products, you can launch AutoCAD P&ID from either the desktop icon or from the program's start menu. This will invoke AutoCAD in the P&ID workspace. The environment should be familiar as it is leveraging standard AutoCAD. The most important elements of the P&ID workspace to become familiar with are the P&ID ribbon, the tool palette and the Project Manager.


Project Manager
Current Project:
_Project Test
Project
Project Test
P&ID Drawings
Plant 3D Drawings
Related Files
Preview
Source Files
Orthographic DWG
Isometric DWG
Lines
Equipment
Valves
Fittings
Instruments
Control Valve
Control Valve
Valves
Gate Valve
Globe Valve
Plug Valve
Needle Valve
Pinch Valve
Check Valve
Ball Valve
Butterfly Valve
Angle Valve
Three Way Valve
Four Way Valve
Knife Valve
Diaphragm Valve
Generic Rotary Valve
Stop Check Valve


P&ID P.P
Autodesk AutoCAD Plant 3D 20 - NOT FOR RESALE Drawing1.dw
Home
Insert
Annotate
Manage
View
Output
Plug-ins
Autodesk 360
Vault
Raster Tools
Weld Lengths
Featured
Project Manager
Data Manager
P&ID Annotate
Assign Tag
Edit Block
Draw
Edit
Ortho
Select Group
Make Group
Edit Group
Drawing Checker
Run Validation
Unsaved Layer State
0
Project
P&ID
Schematic Line
Line Group
Validate
Layers

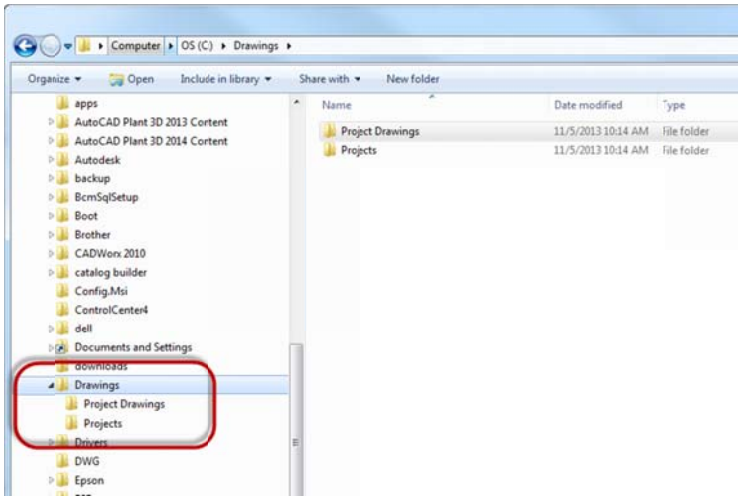
Creating a project

In AutoCAD P&ID you will create P&IDs in a project environment. This is an administrative task not typically done by all drafters, but for the sake of familiarity with the concepts of the project environment we will create a new project with folders and subfolders.

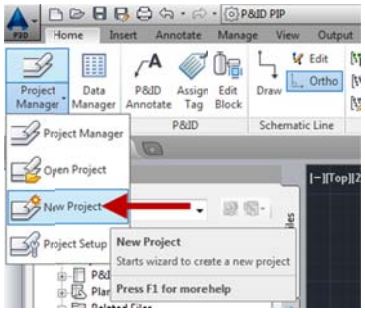


The following exercise will demonstrate how to separate project folders and files from the drawings you create. These folders and subfolders get their own specific settings as we will see in this exercise. Once you've established the required structure you will create some new drawings. So, be sure to save this structure, because you will need it later.

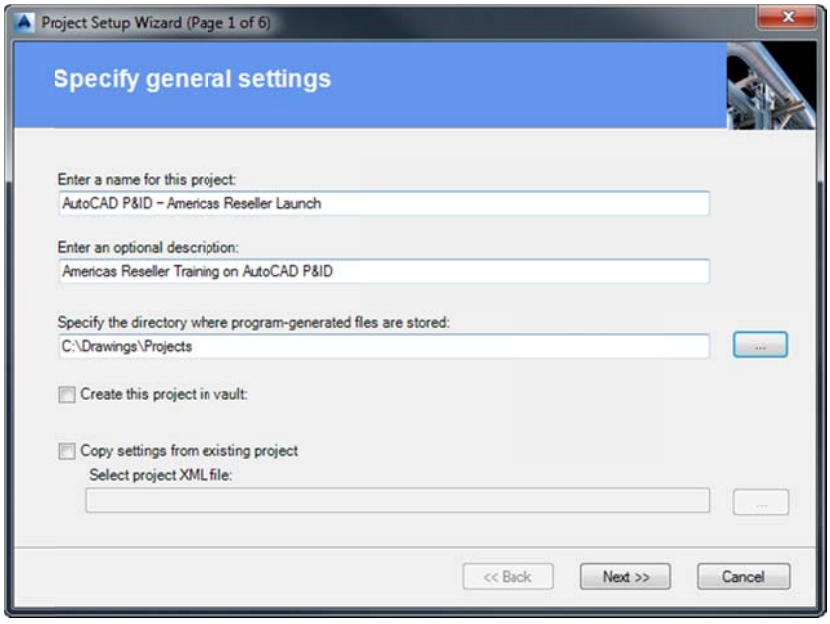
1. First setup the project structure you need to use by create a folder C:\Drawings and the sub-folders Project Drawings and Projects.



2. Click on the Project Manager drop-down and select New Project.



3. Fill in the first page in the new project wizard.
    a. **Project Name**: AutoCAD P&ID – Americas Reseller Launch
    b. **Description**: Americas Reseller Training on AutoCAD P&ID
    c. **Location:** C:\Drawings\Projects
4. Click Next.



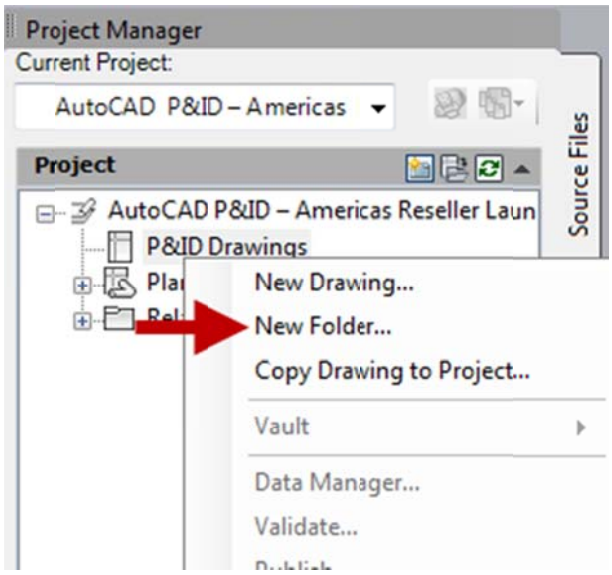
5. Choose Imperial units, click Next.

6. For the Symbols choose PIP, enter C:\Drawings\Project Drawings for the drawing path. Click Next.

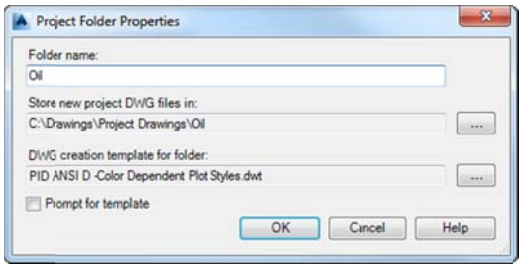
7. Leave the rest of the settings as is, and click Next until you reach the final dialog where you should make sure Edit additional project settings is unchecked. Click Finish.

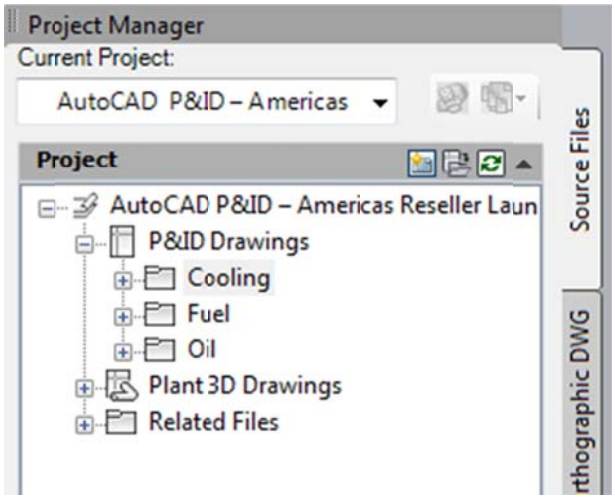
Next you will create some folders to help organize the P&IDs. To create the folders, you will use the project manager.

1. Right-click on the P&ID Drawings item, and choose New Folder.



2. Create the Oil, Fuel, and Cooling folders.



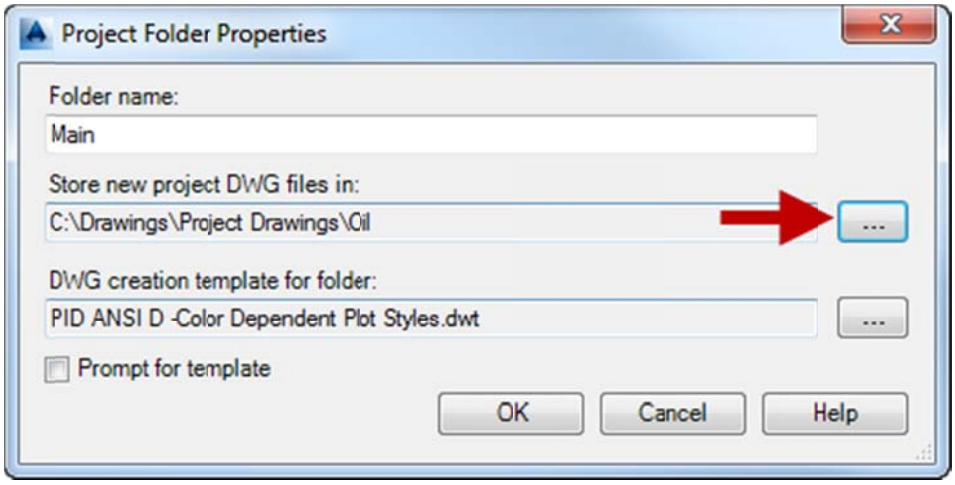


Notice the check in the "*Prompt for template"* checkbox when we create the Cooling folder. When you create a drawing in Oil or Fuel the project default template will be used. But, you will be prompted for the template when you create drawings in the Cooling folder.

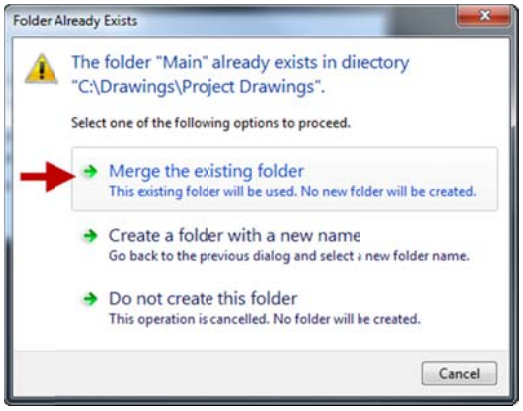
Now, let's create more subfolders in Oil, Fuel and Cooling. The folders we create in this part of the exercise are for organization within the project tree. By default when we type the folder name, the program will create it; in order to create a virtual folder, click the browse button and choose the folder you wish the

drawings to actually be stored in. The folder will be created in the project manager, but the storage location will be where you picked.

1. Right-click on the parent directory (Oil) and select New Folder from the menu.
2. Enter the new folder name (Main).
3. Click the browse button, and choose the C:\Drawings\Project Drawings\Oil folder.

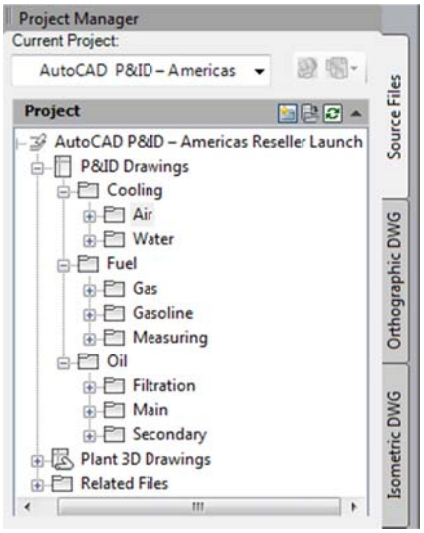


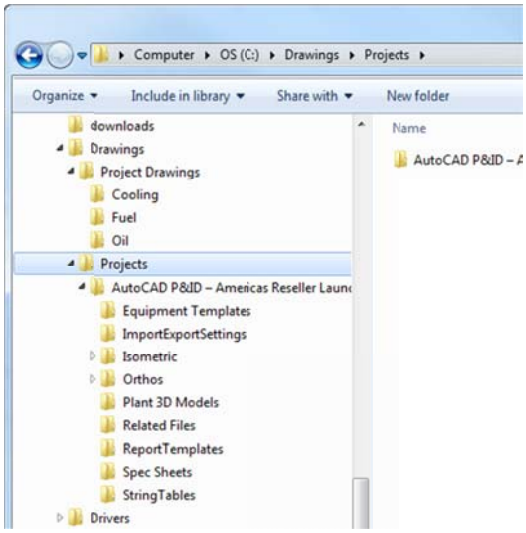
4. When you click ok, you will get prompted to select how the program should proceed. Choose Merge.



Now that you understand the procedure, create the following subfolders: In **Oil** create the Main, Secondary and Filtration folders. In **Fuel** create Gas, Gasoline and Measuring. In **Cooling** create Water and Air

When you finish creating the project the project tree should look like this:



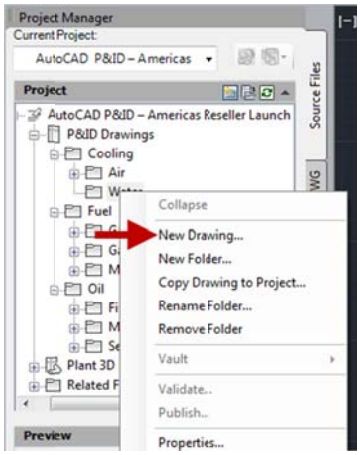


Create a drawing and place equipment

Create drawing

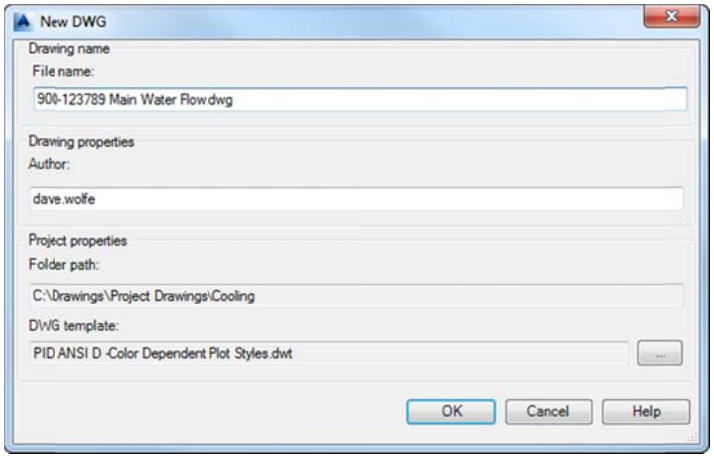
Now we will start a new drawing in the project you just created. This P&ID is going to be created in the Cooling folder and is part of the Water subfolder.

1. Right-click on the Water folder and in the menu select New Drawing.

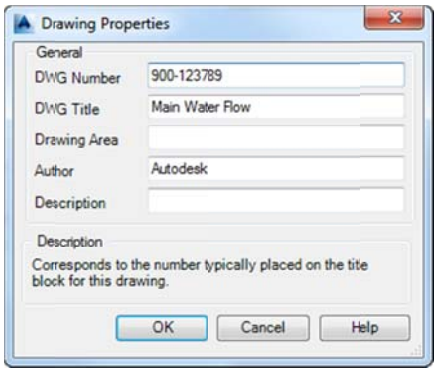


2. Enter values as shown below:

Equipment	Tag (enter this in dialog)	Location on Drawing
Open Top Tank	TK-300	Up at top



3. Right-click on the drawing in the project manager, select properties, and enter these values.



Place Equipment

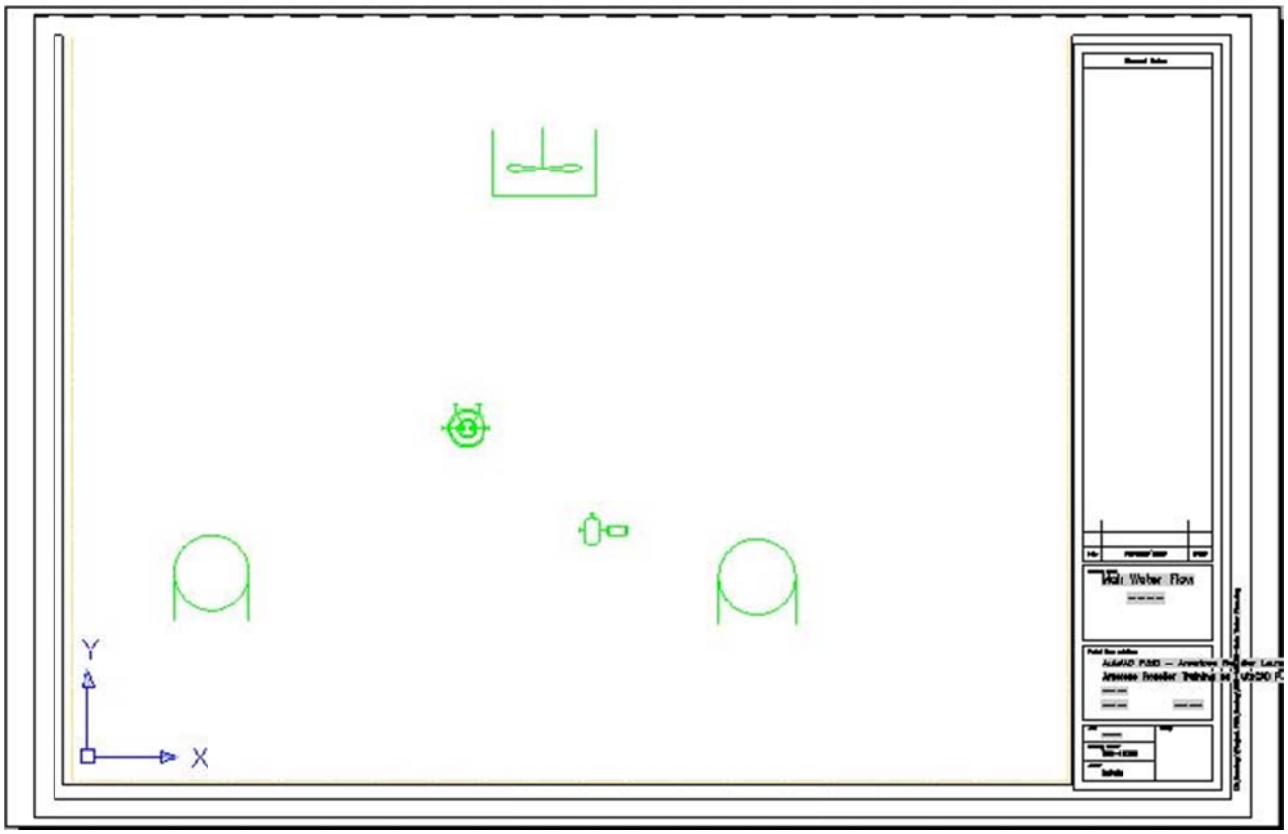
We are now ready to add items to the drawing. You will place 6 pieces of equipment, to start. You will find the equipment in the Equipment tab of the Tool Pallet. While you can drag symbols from the Tool Pallet to your drawing, it is best to click on the equipment you want to place and then click again where you want it located on the drawing. Place the following equipment with the indicated tag and location on the drawing:

Equipment	Tag	Location on Drawing
Open Top Tank	TK-300	Up at top
Propeller Agitator	No Tag	Inside Tank
Spherical Tank	TK-100	At bottom left
Spherical Tank	TK-050	At bottom right
Spiral Heat Exchanger	E-150	Low Center
Horizontal Centrifugal Pump	P-100	Bottom Center

Propeller Agitator	The agitator has no tag	Inside tank
Spherical Tank	TK-100	At bottom on the left
Spherical Tank	T-K050	At bottom on the right
Spiral Heat Exchanger	E-150	Low center
Horizontal Centrifugal Pump	P-100z z	Bottom center

NOTE *Depending on project settings, you may be prompted to place these tags on the drawing right after assigning a tag number.*

When you finish your drawing should look something like this: Save your drawing. We will use it as we continue through the exercises.



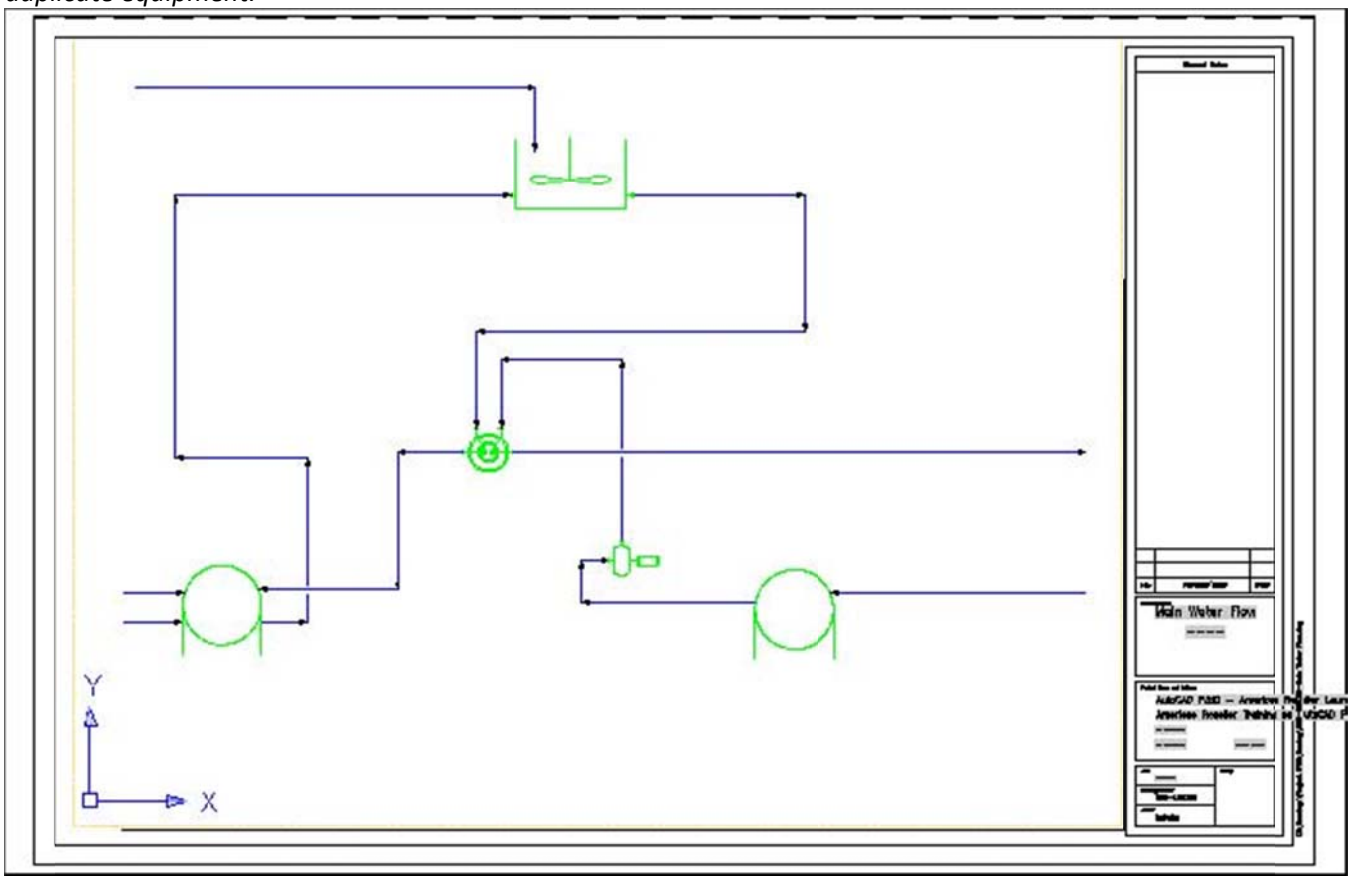
Adding primary and secondary lines

Primary lines

We will now add primary and secondary lines to connect the equipment we just placed. The direction of flow for the lines will be determined by the direction you create the lines. If necessary, the direction can be changed. We will cover this later, when we look at the editing tools.

1. Select Primary Line from the Lines tool pallet and start creating the lines in the following diagram.

   HINT *Use the right-click Repeat and Recent Input options to speed placement of lines and duplicate equipment.*



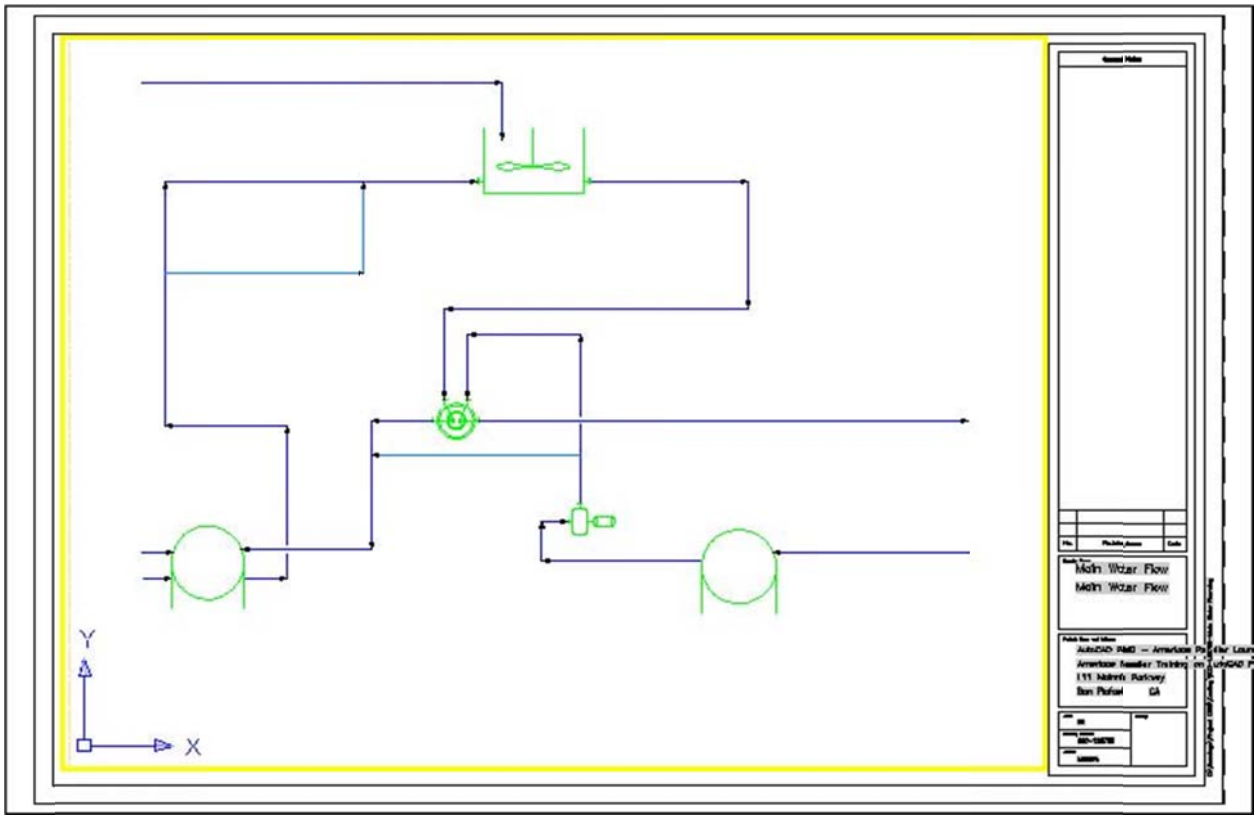
HINT *To determine if a line is attached to a piece of equipment, select it. If it is attached, there will be a circular shaped grip at the attached end. If not, the grip will look like a plus sign (+).*

Secondary lines

When your drawing looks like the one above, you are ready to add some secondary lines. Your color scheme may not match what you see in our diagrams. You can set your color preferences in Project Settings and we will cover that later.

Select Secondary Line from the Lines tool pallet and start creating the lines shown in the following diagram.

Aside from the color differences, your drawing should look like this: Now save your drawing and we will move on to the next topic.

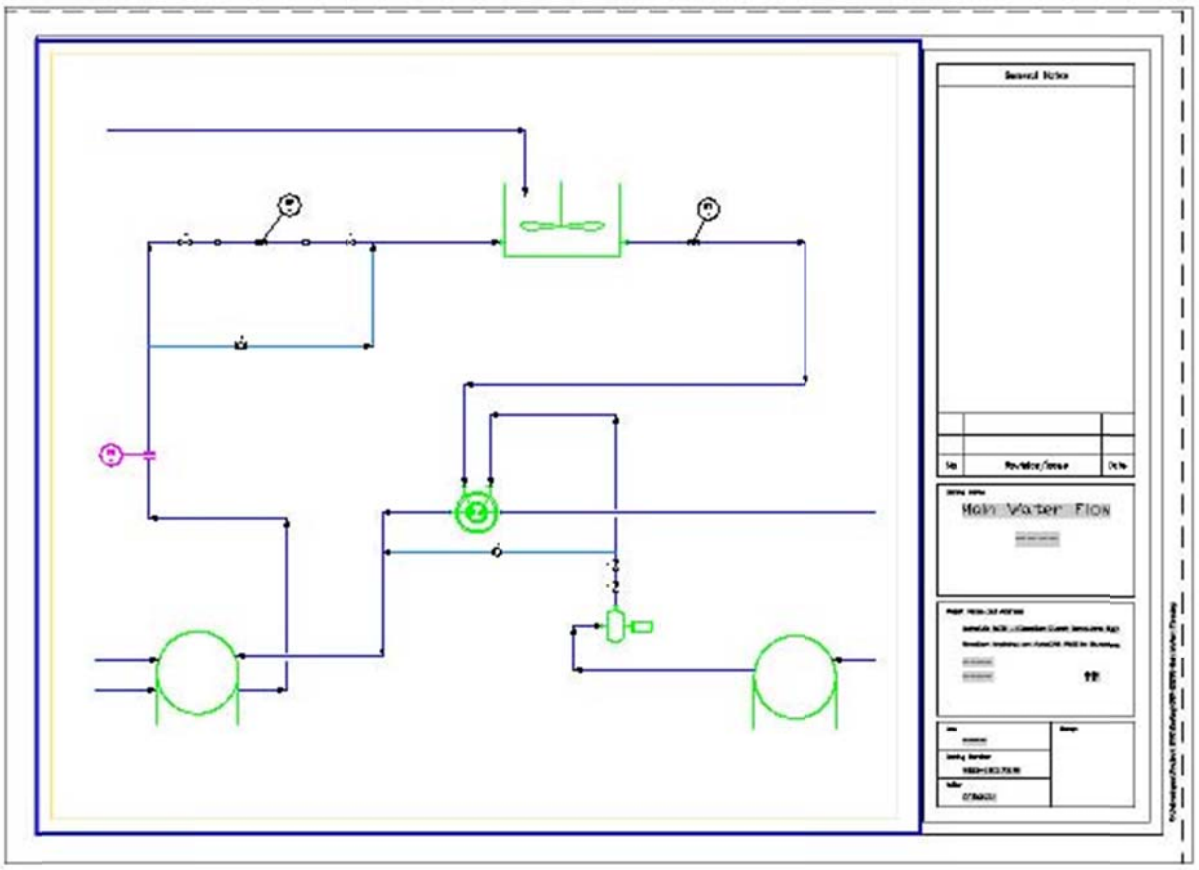


Placing inline components

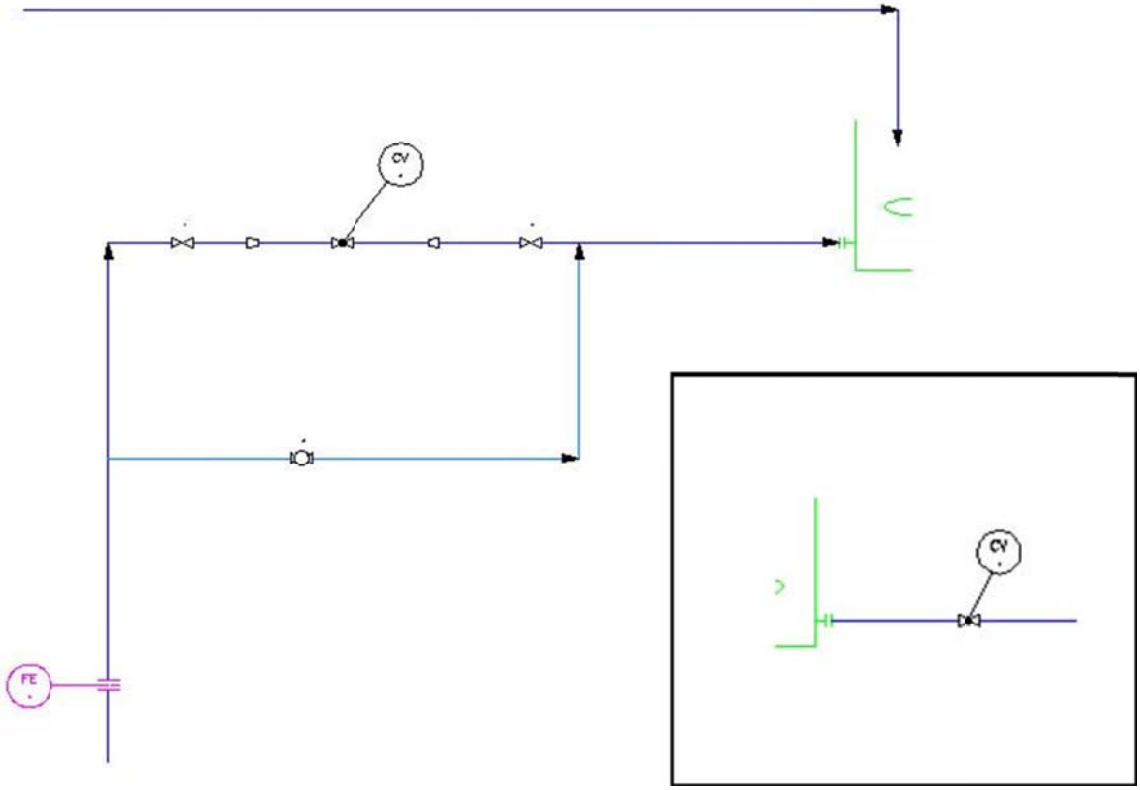
Now that you have completed the basic layout of your P&ID, it is time to place some inline components such as hand valves, check valves and control valves. You will add these components on both sides of the tank, near the pump and at the heat exchanger.

You should place them according to the following diagram. Remember, inline components can be modified later.

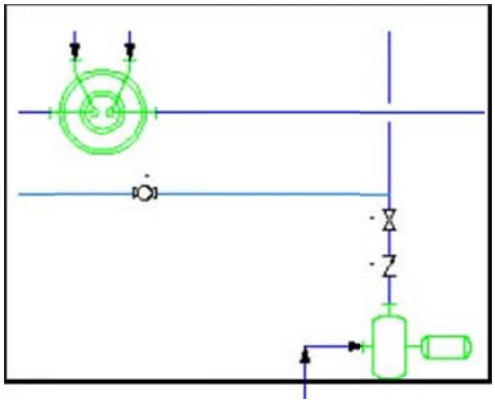
Select a valve symbol from the Valves tool pallet and start placing the valves shown in the following diagram (reducers are found in the Fittings palette and instruments, in the Instruments palette).



To help you with the location of these components we created the following detail views:



At the sides of the tank, left and right ***NOTE*** *To flip the direction of a reducer, select it and click on the Flip grip (arrow shape).*



Around the heat exchanger

After placing your inline components, save your drawing.

Adding Instrumentation and tags

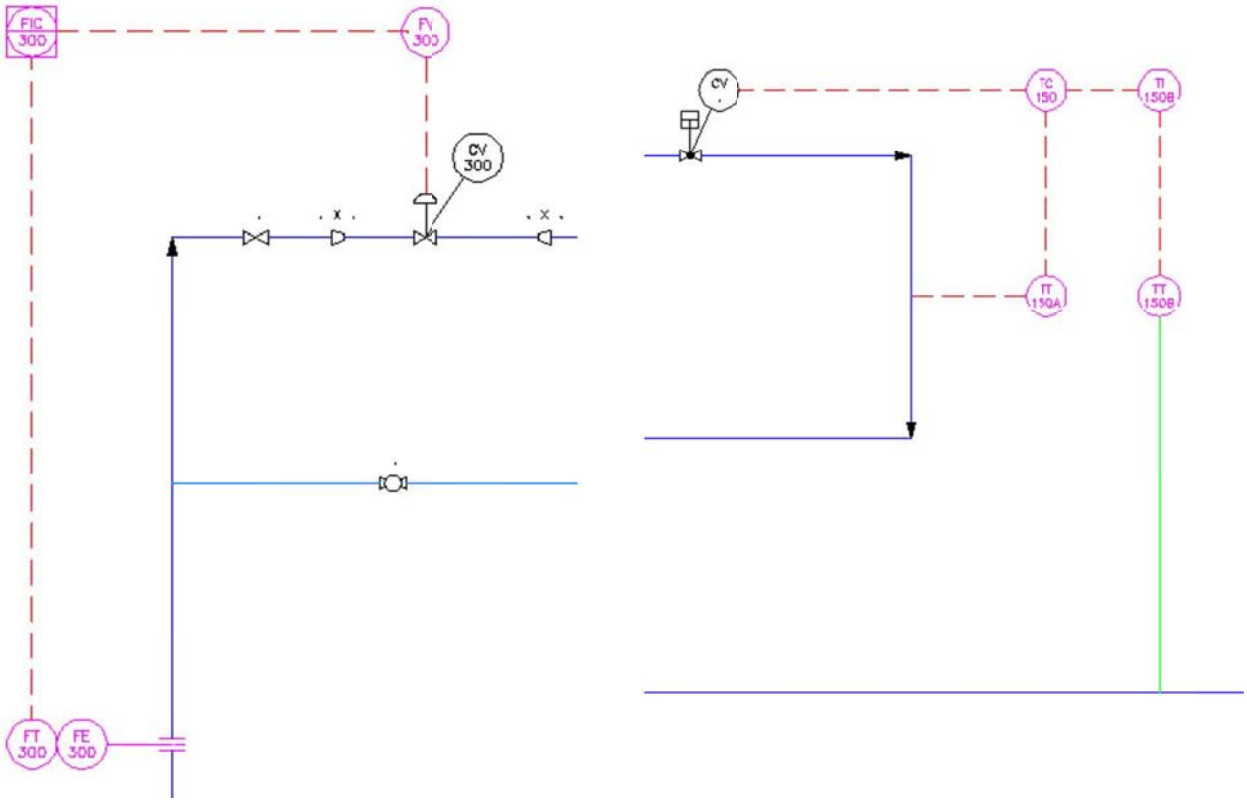
Add instruments

As you probably know, instrumentation is very often connected to control valves and/or other regulating inline components. They react on signals – such as, pressure, temperature or flow – that they receive from

the process lines they are attached to. In this exercise, we are going to build some instrumentation loops connected to control valves, flow transmitters and temperature indicators. We will also add some tags to the equipment. You will see your drawing starting to look like a real P&ID.

In the next figure, you will see what instrument you should place and where it should be placed.

1. Select the appropriate instruments from the Instruments palette. Place them in the locations shown in the following diagrams.
2. Select the signal line from the Lines palette (and one tubing line). Connect the instruments, as shown.

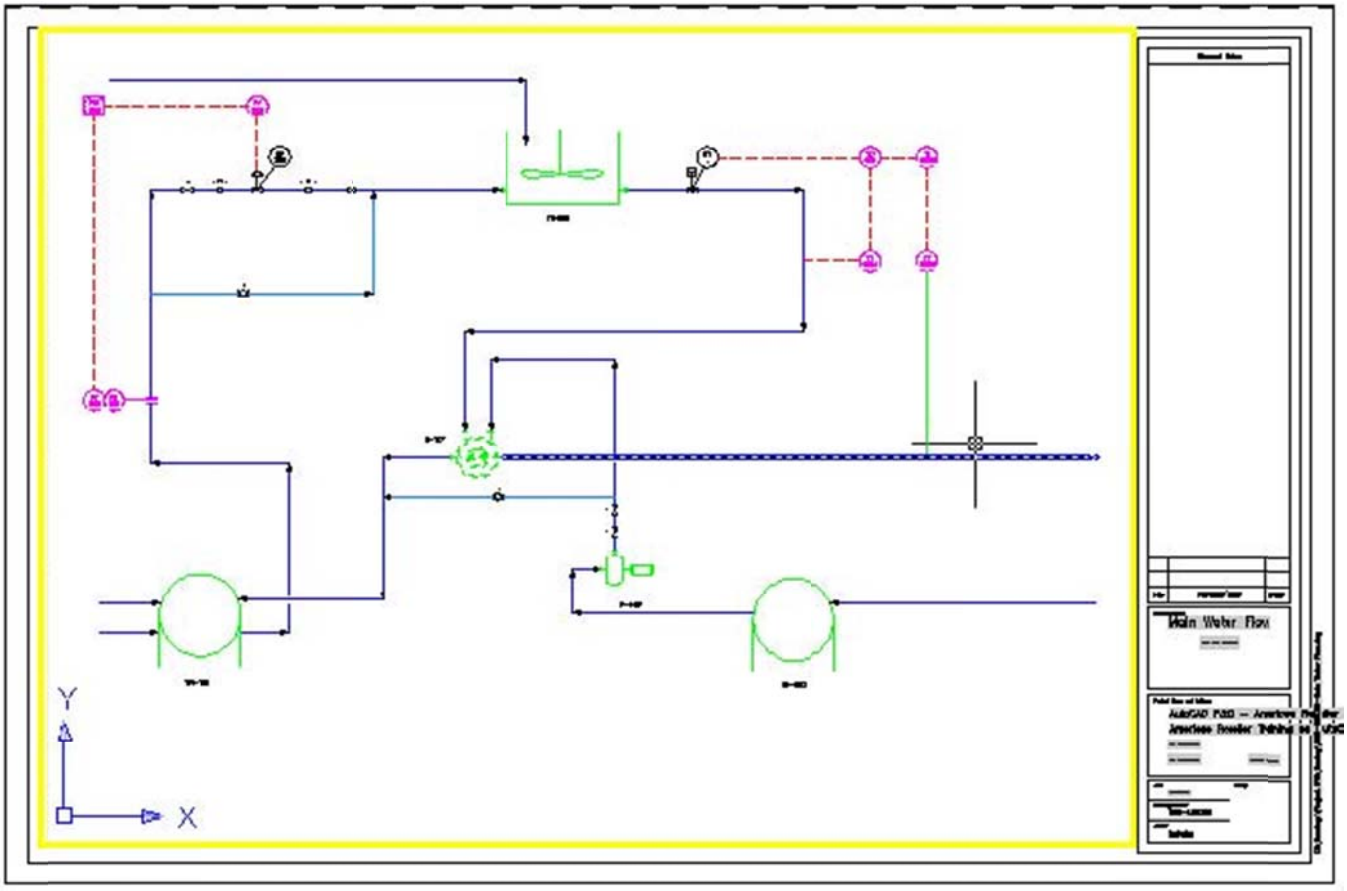


When you have finished the instrumentation, save your drawing.

Add tags

Next we will add tags to the equipment. Place the tags by right-clicking on the equipment you want to tag and selecting Annotate -> Tag.

Add tag information in the dialog. 3 Position your tags as shown in the next figure.



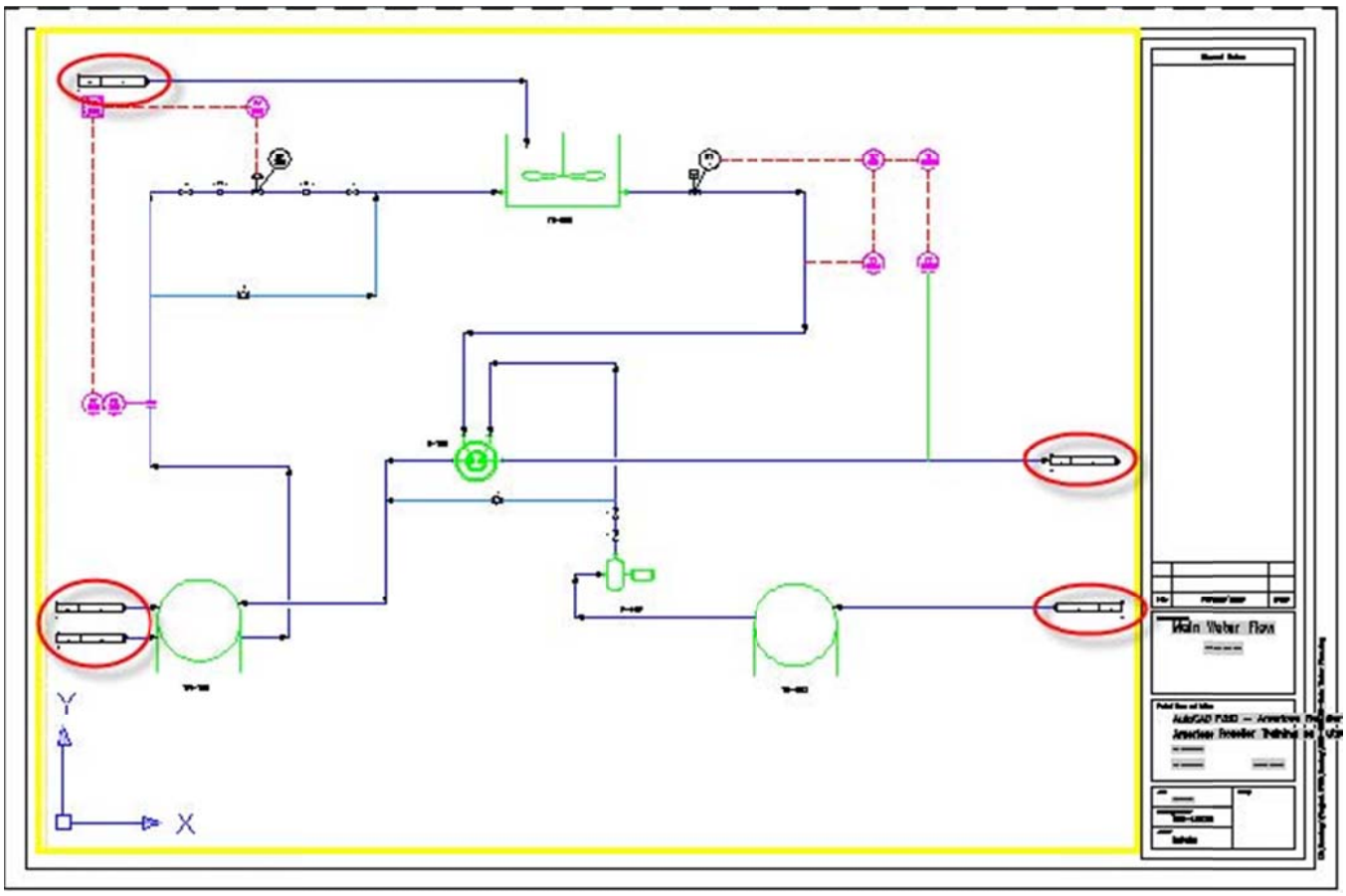
Save your drawing.

Offpage Connectors

Place Connectors on first drawing

Quite often a process is laid out on multiple drawing sheets. The continuation of a pipeline from sheet to sheet is marked by using Offpage Connectors. In this exercise we will add another sheet to our drawing and connect the continuous pipelines with Offpage Connectors. Let's start with the drawing we've already made.

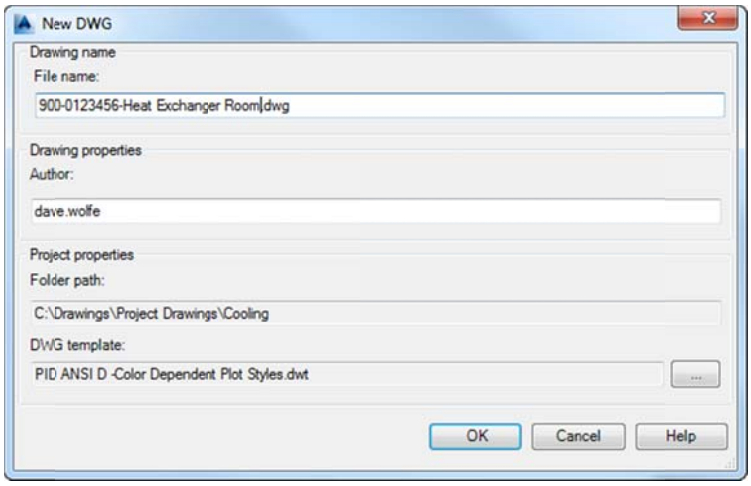
1. In the Non-engineering palette, select the Offpage Connector symbol.
2. Place the 5 Offpage Connectors as shown in the following diagram. We will add required information to these arrows in a later exercise.



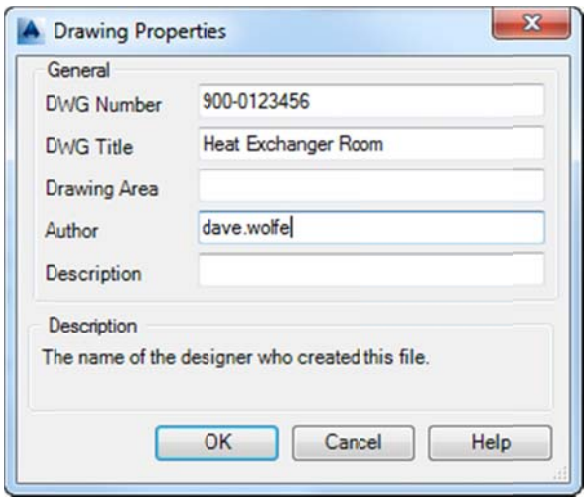
Create second drawing

Now that you've placed these connectors, you need another drawing to connect them to. We will create a new drawing in the Cooling folder, Water subfolder.

1. Right-click on the Water subfolder and create a new drawing.
2. Enter the following information into the New DWG dialog.

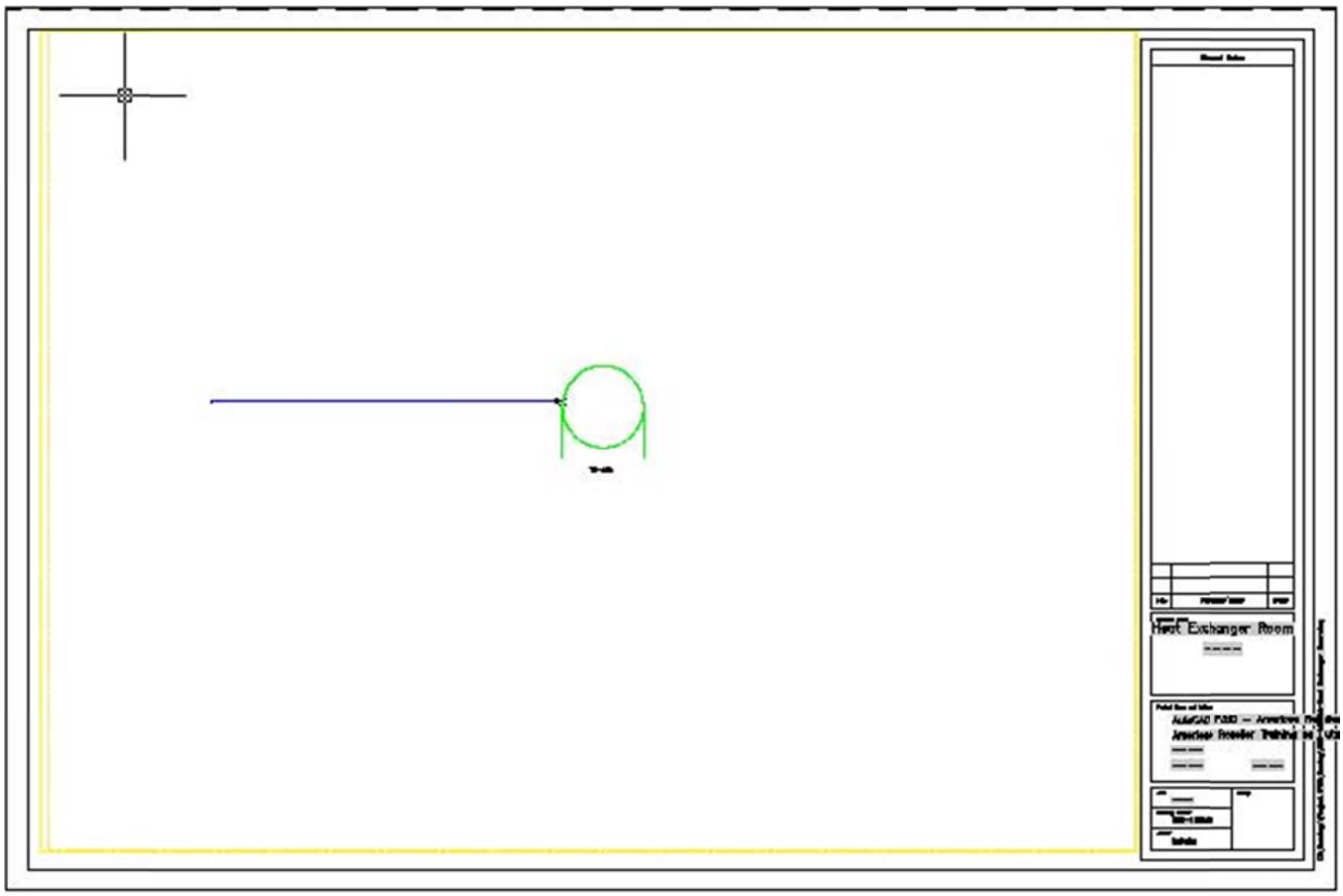


3. Right-click the drawing in project manager and enter the following properties:

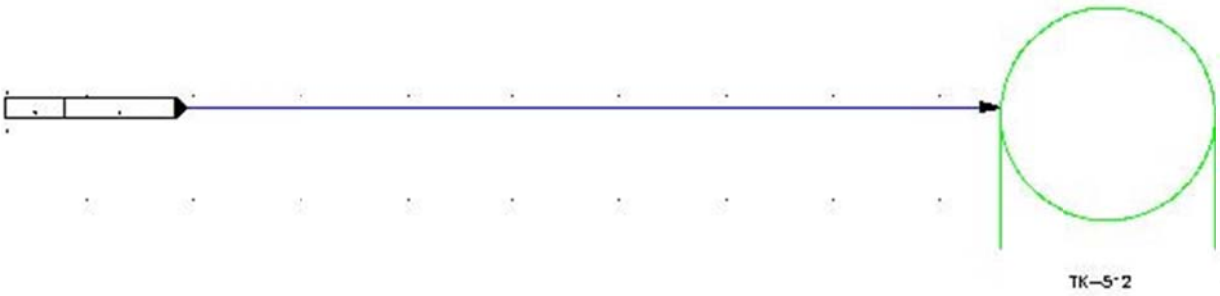


Place items on new drawing

Place a tank on the new P&ID and give a tag of TK-512. Draw a primary line from the left edge of the drawing to the tank as shown in the next figure.



Now place an Offpage Connector at the left end of the primary line you just created. This is where this line will connect to the same line on the other drawing. It will correspond with the connector coming from the Heat Exchanger H-150. It should look something like this:



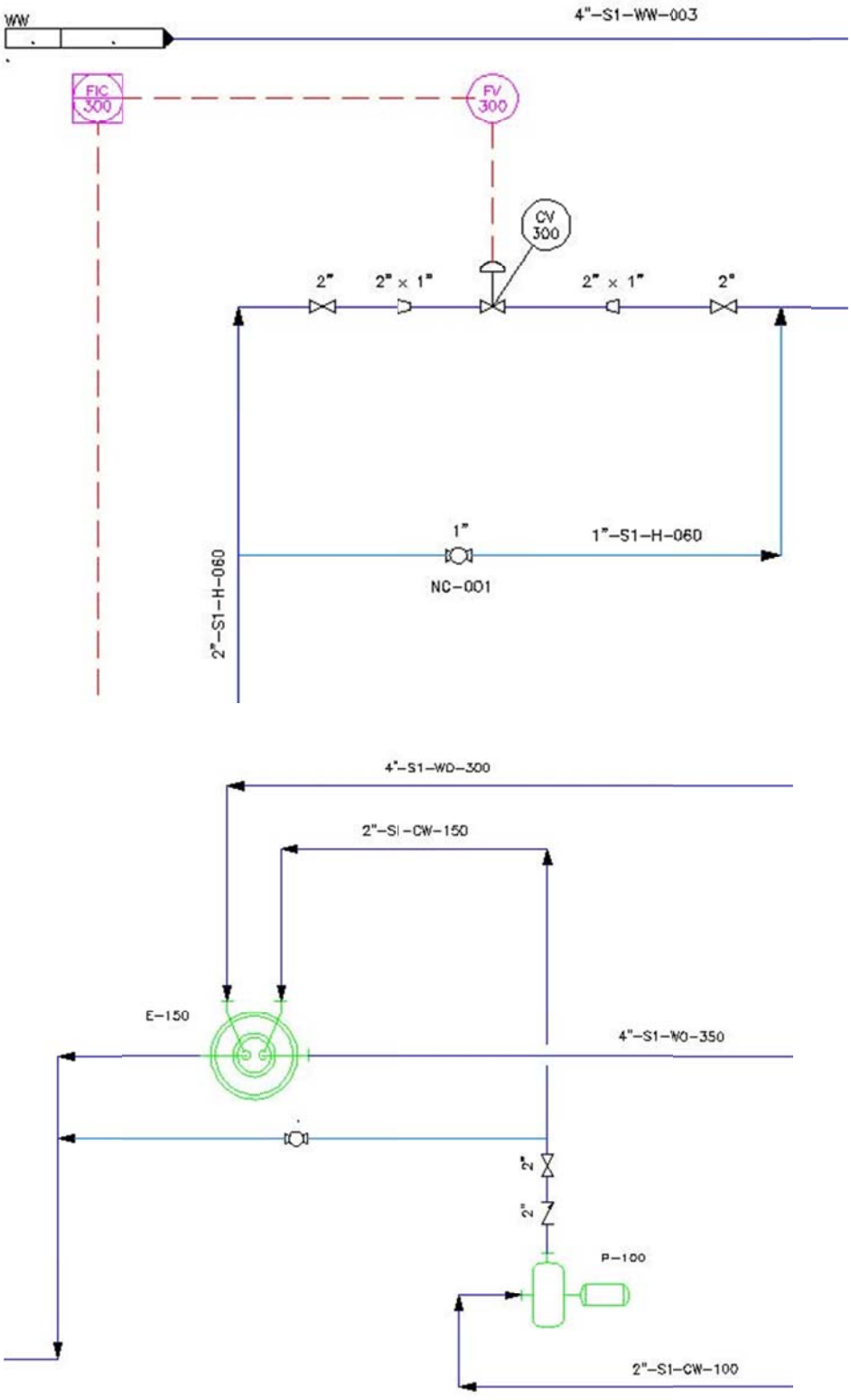
Save both drawings before we continue to the next exercise.

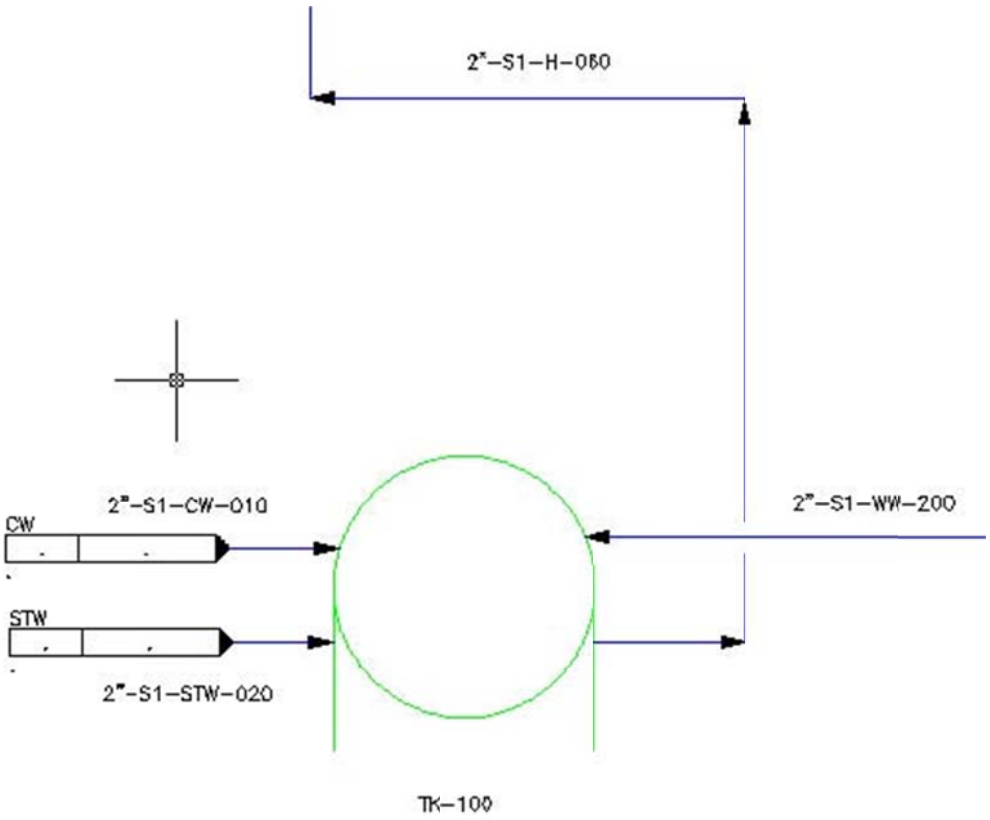
Tagging Pipelines

In the following figures you will see the sizes, specs, service and line number that should be entered at the tag assignment for each line. After entering the necessary information you will also need to place the different tags near the appropriate pipeline. These tags will be placed in the first drawing you created.

NOTE *If the box is checked next to Place annotation after assigning tag, you will be prompted to select a location for the tag in the same operation.*

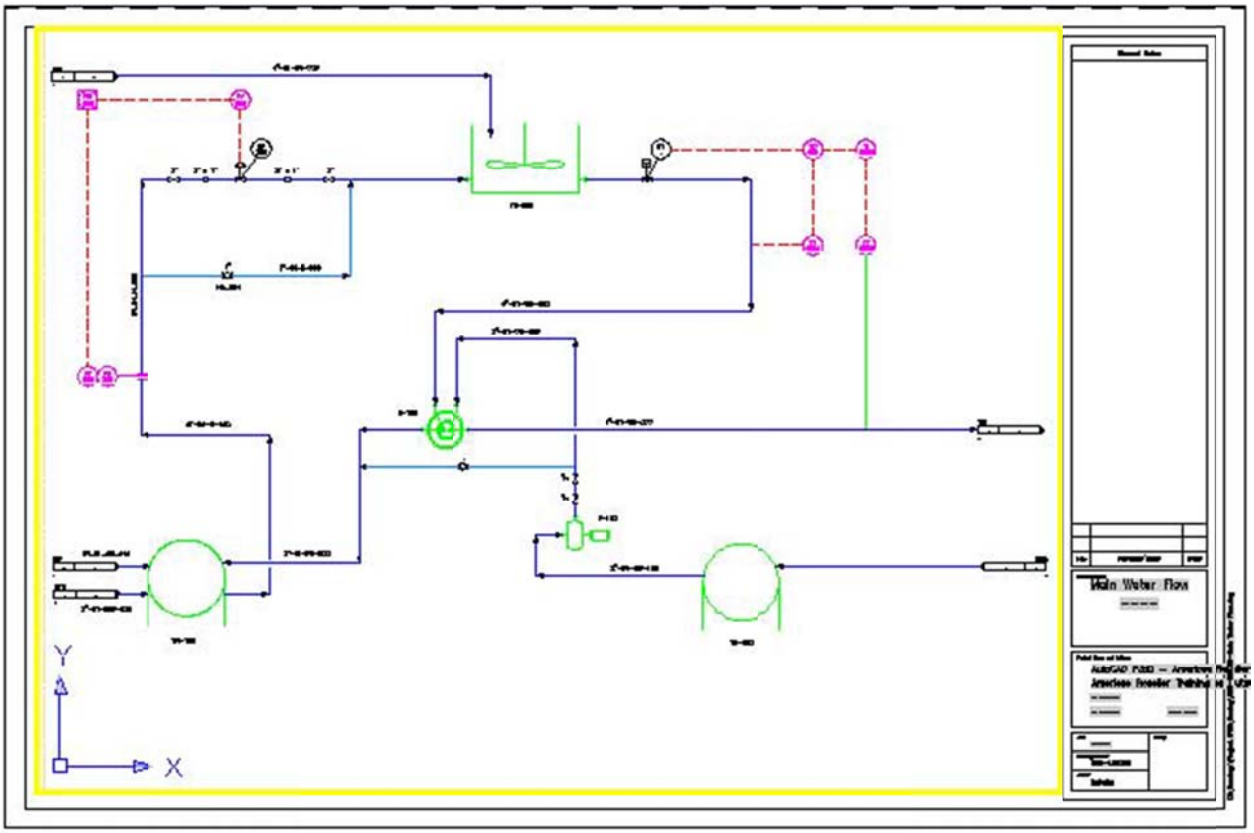
1. Right-click over a line and select Assign Tag…
2. Fill in the appropriate size, spec, service and number for each line you see in the following diagrams
3. Edit the reducer annotations to get the appropriate tag.


WW
4"-S1-WW-003
FIC 300
FV 300
CV 300
2"
2" x 1"
2" x 1"
2"
1"
1"-S1-H-060
NC-001
2"-S1-H-060
4"-S1-WO-300
2"-SI-CW-150
E-150
4"-S1-WO-350
2"
2"
P-100
2"-S1-CW-100



Detail view showing tag locations and added information. Descriptions will be handled later when we cover Data Manager.

When you have finished, the drawing should look like the one below.

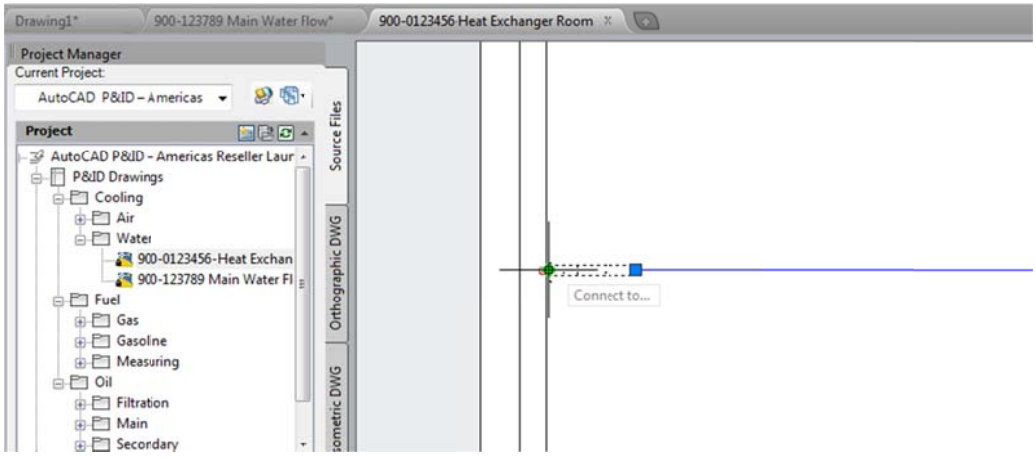


Connecting Off Page Connectors

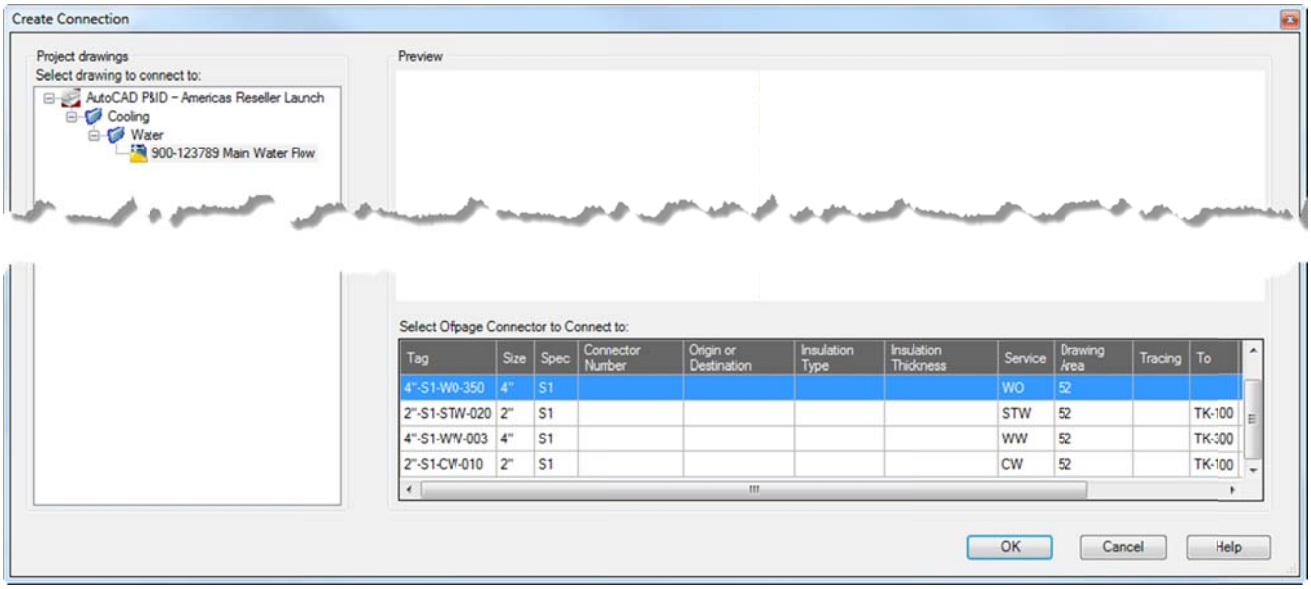
In 2014, the off page connector functionality was modified. The program assumes the following:

1. We are trying to connect to an existing off page connector. We cannot place connectors through the connection routine.
2. The off page connector is in model space. The viewer currently shows only model space. However, as long as you know the line number you are connecting to, you can select it from the list.

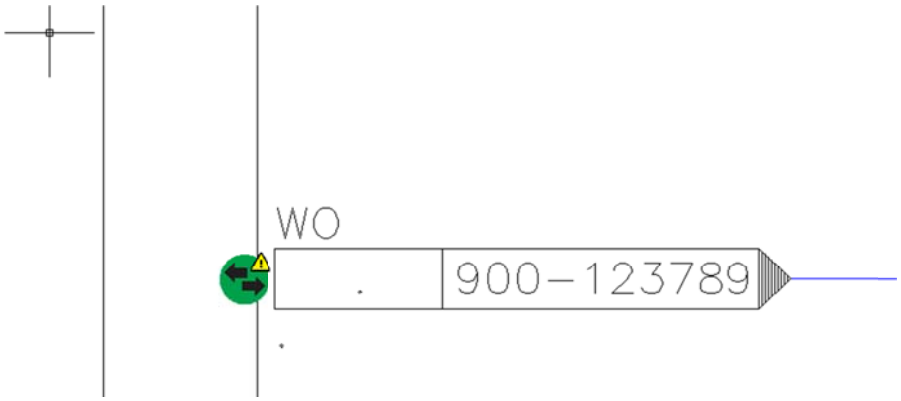
In the heat exchanger drawing, select the off page connector, click the + grip, and choose Connect.



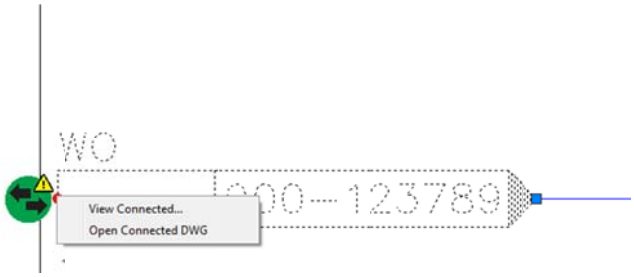
From the list of displayed lines, choose 4”-S1-WO-350, and click OK.



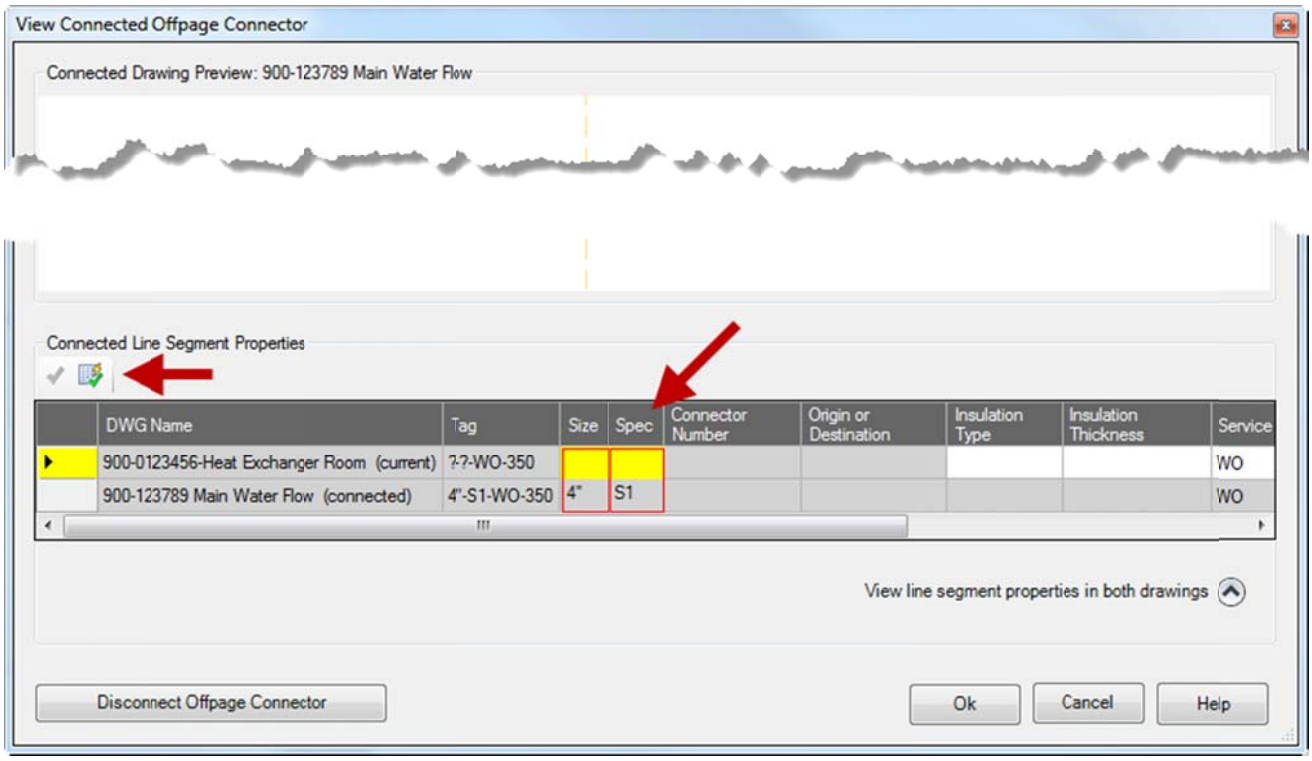
The drawing number and service should have populated the OPC. You will also see a yellow exclamation warning which indicates that properties between the two drawings are out of sync.



Select the off page connector, pick the circle grip, and choose View Connected.



The connection dialog shows which properties are out of sync. In this case, the size and spec in our current drawing has not been updated to match the drawing we connected to. Click the Accept Changes button to update the current drawing with the values from the connected drawing.



If you have placed a pipeline annotation, it should update correctly, as your lines are linked across drawings now.

Adding Drawing and Project Properties

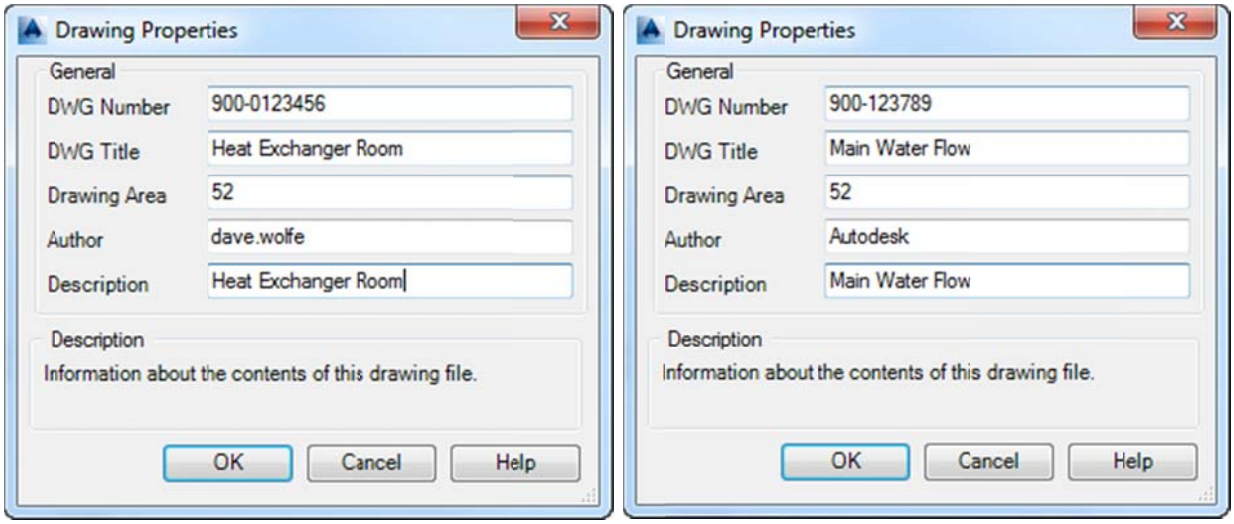
Drawing properties

It is important to capture all relevant data not only on the drawing, but in the data model, as well. Since this is an intelligent P&ID application data stored in the data model will automatically show in the appropriate location on the drawing. Other data not typically shown on the drawing will be used in common reports. We'll talk about reporting later. Right now, we want to add more information into our project and drawing properties.

In the following figures you will see the drawing and project properties to enter for this exercise. You should see from/to drawing information that was automatically added to the connectors (this may require a Rebuild, first).

1. Right click on each of the two drawings and select Properties.
2. Enter the information from the following diagrams.

NOTE *The Author field is automatically filled.*



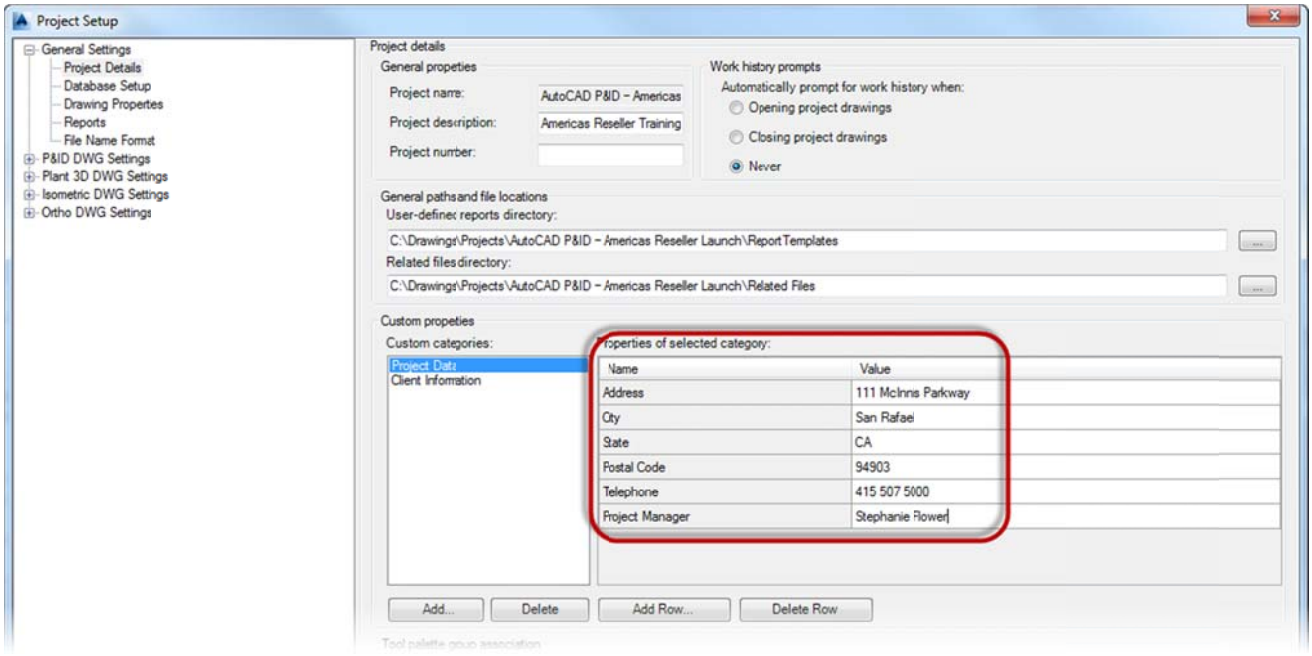
Drawing Properties to be entered.

Project properties

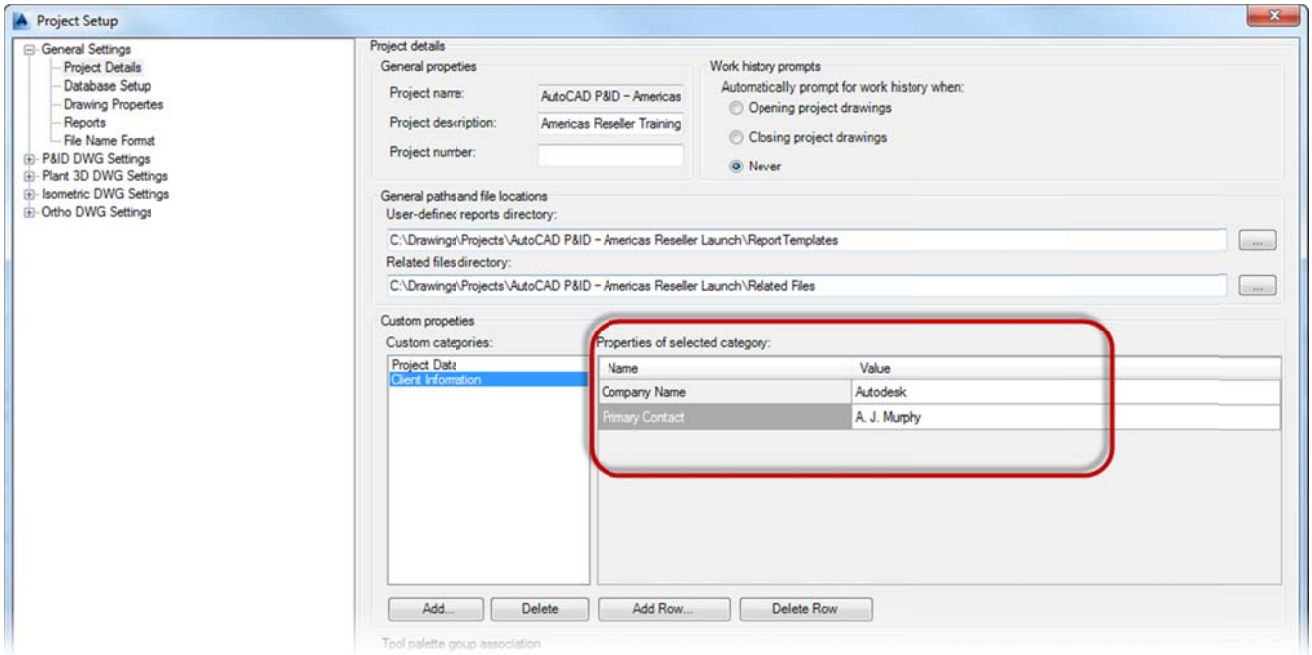
In the Project Setup dialog you will want to enter information in both Project Data and Client Information. Enter the information that is shown in the following diagrams.

1. Right-click on the project name and select Properties.
2. Enter information into the Project Data fields.
3. Select Client Information and enter information for those fields.

NOTE *These are the default fields for a project. More fields can be added and these fields can be deleted. Categories can also be added and deleted.*



Project Data properties to be entered.

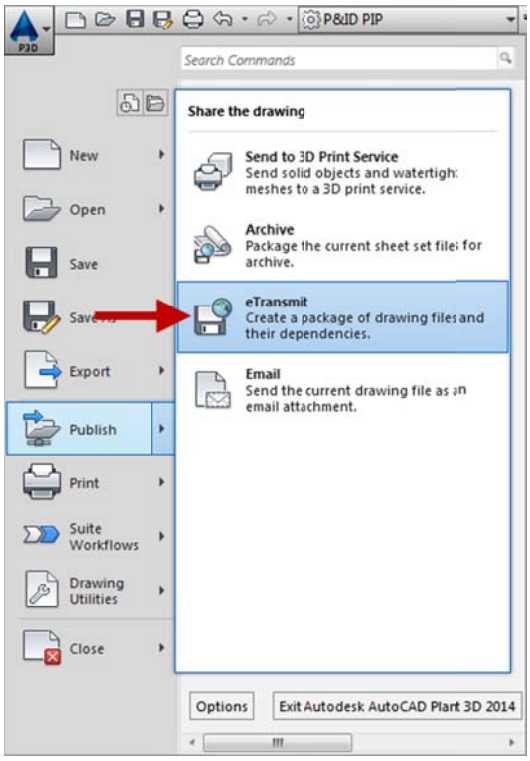


Client Information properties to be entered

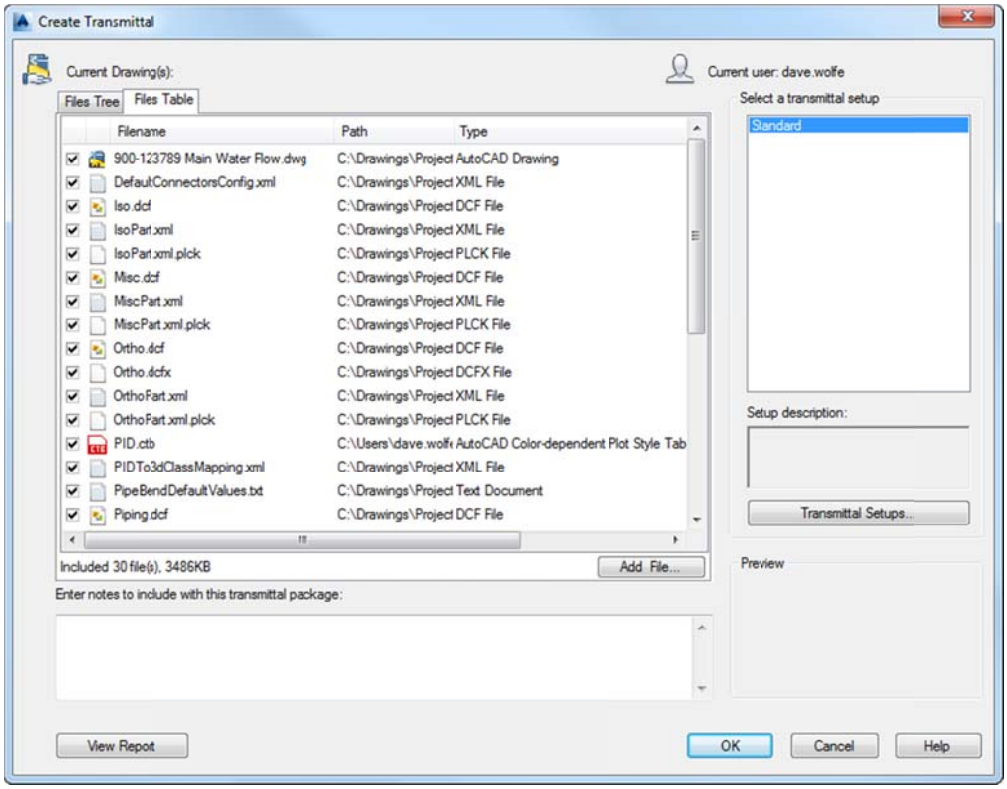
When you are done entering the information, save your drawings.

Project Transmittal

To get started creating a package of files in our project, start the ETRANSMIT command by going to the application menu > Publish > eTransmit. You will be prompted to save your drawing.



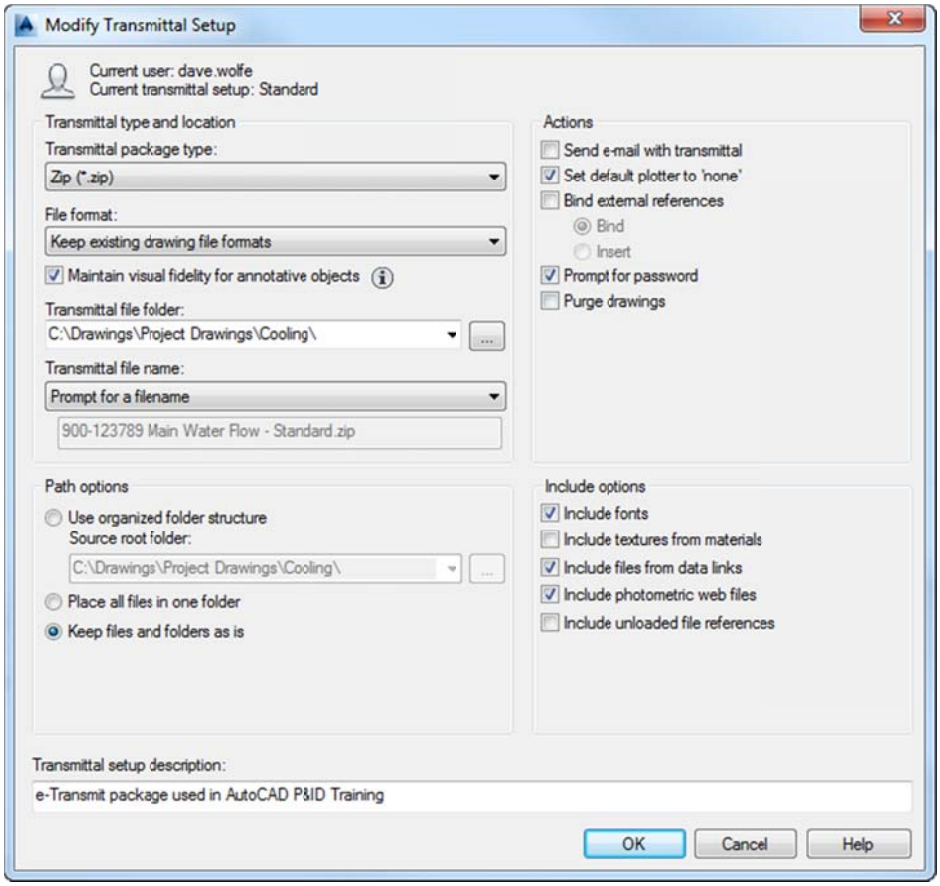
Click Add File and browse to the Project folder, which for this project is C:\Drawings\Projects\AutoCAD P&ID -Americas Reseller Launch. Add all of the files in that folder.



Add any drawing that are necessary.

E-transmit example

1. Click Transmittal Setups…
2. Select Modify.
3. In our e-transmit, the following settings are required: **Package type:** Zip **File Format:** Keep Existing **Transmittal Options:** Keep files and folders as is, Include Fonts, Include files from data links, Include photometric web files , Set default plotter to None, Prompt for password, **Transmittal Description:** e-Transmit package used in ACAD P&ID training



e-Transmit settings

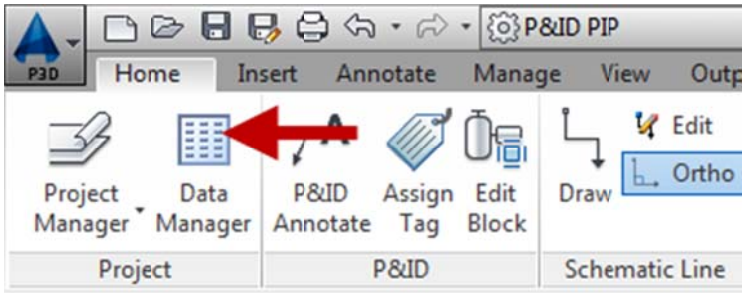
When these settings have been made you can create your transmittal in the same directory as the project settings and project drawings.

Data Manager

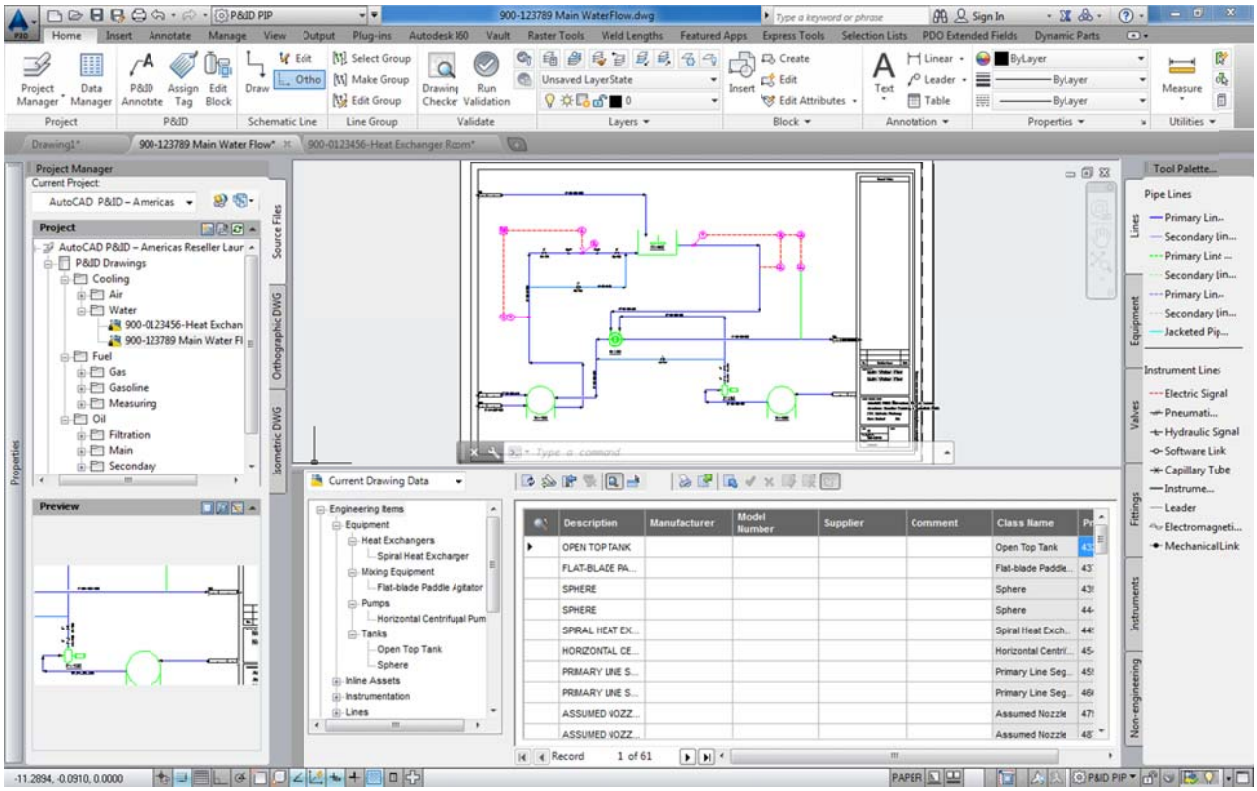
You can use the Data Manager to view, edit, and manipulate your component and line data and to generate reports that you export to and import from Microsoft Excel. In this exercise we will add extra information to the different types of equipment using the Data Manager. This information is necessary to determine the type of equipment, the settings of the equipment and all other related information that is used for building the system you designed with AutoCAD P&ID.

In this exercise you will need to work in the drawing, Main Water Flow (the first drawing you created). You will add information to the equipment and to the offpage connectors you created earlier.

Also, you will need to make sure the Data Manager is active. If the data manager is not displayed at the bottom of your workspace, you need to click on the Data Manager icon in the AutoCAD P&ID ribbon or enter datamanager at the command prompt.



AutoCAD P&ID ribbon

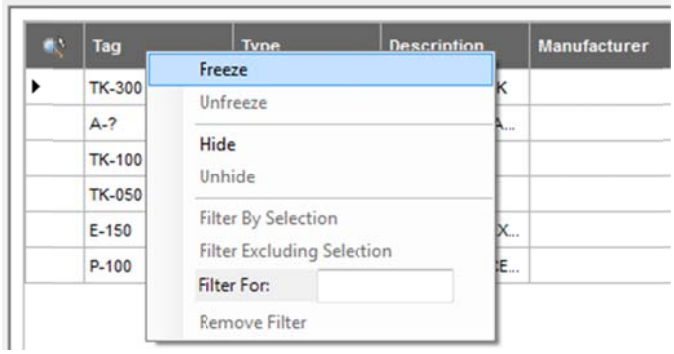


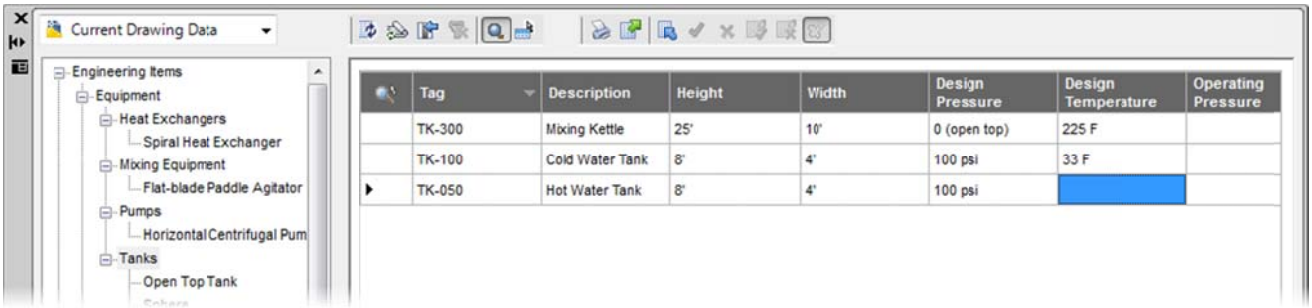
The Data Manager, in Project Data Mode

Make sure the Data Manager is in Drawing Data mode (check the dropdown at the upper-left of the Data Manager).

Add the following information to your equipment:

a. Browse to Engineering Items > Equipment > Tanks and enter the following property data.
***NOTE** Your columns will probably not be in the same order as shown in these diagrams. Use the scroll bar at the bottom of the Data Manager to scroll over to these columns.*
***NOTE** To undock a palette and move it to a location without allowing it to dock, hold down Ctrl.*
***NOTE** You can freeze columns in place by right-clicking on the header and choosing freeze.*





b. Browse to Engineering Items > Equipment > Pumps and enter the following property data.

Description	Tag	Manufacturer	Flow Capacity	Total Dynamic Head	Model Number
Hot Water Pump	P-100	Goulds	50 Gpm	25'	

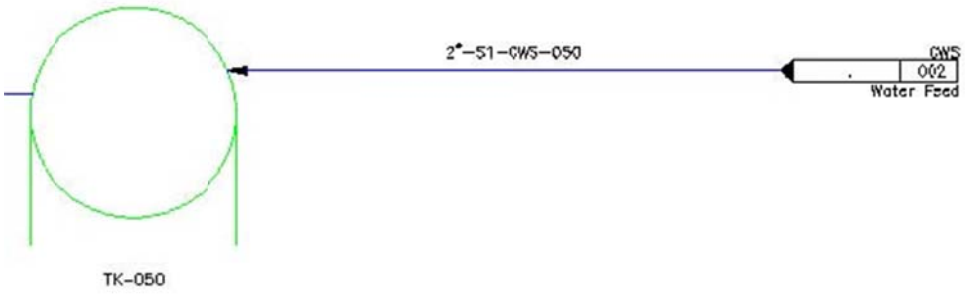
c. Browse to Engineering Items > Equipment > Heat Exchangers and enter the following property data.

Description	Tag	Shell Design Pressure	Shell Design Temperature	Tube Design Pressure	Tube Design Temperature
Spiral Heat Exch...	E-150	100 psi	32 F	100 psi	

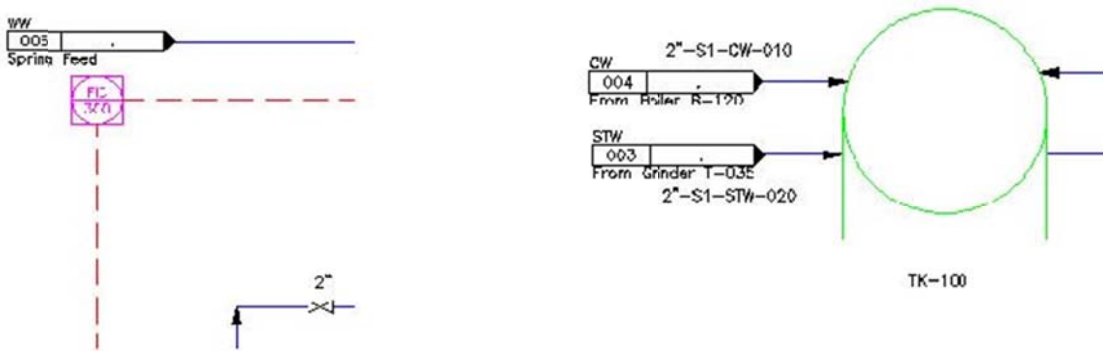
d. Browse to Non Engineering Items > Connectors > Off Page Connectors and enter the following property data.

	Connector Number	Description	Comment	Class Name	PnPID	Origin or Destination
▶	001	Off Page Connec...		Off Page Connec..	757	Cool Wort to Fermentor T-512
	002	Off Page Connec...		Off Page Connec..	763	Water Feed
	003	Off Page Connec...		Off Page Connec..	765	From Grinder T-035
	004	Off Page Connec...		Off Page Connec..	767	From Boiler B-120
	005	Off Page Connec...		Off Page Connec..	769	Spring Feed

NOTE *To help clarify which data go with which connector, see also the diagrams after the table.*



Right hand side of drawing.



Top left of drawing Bottom left of drawing

3 When you have entered all of the data, save the changes.

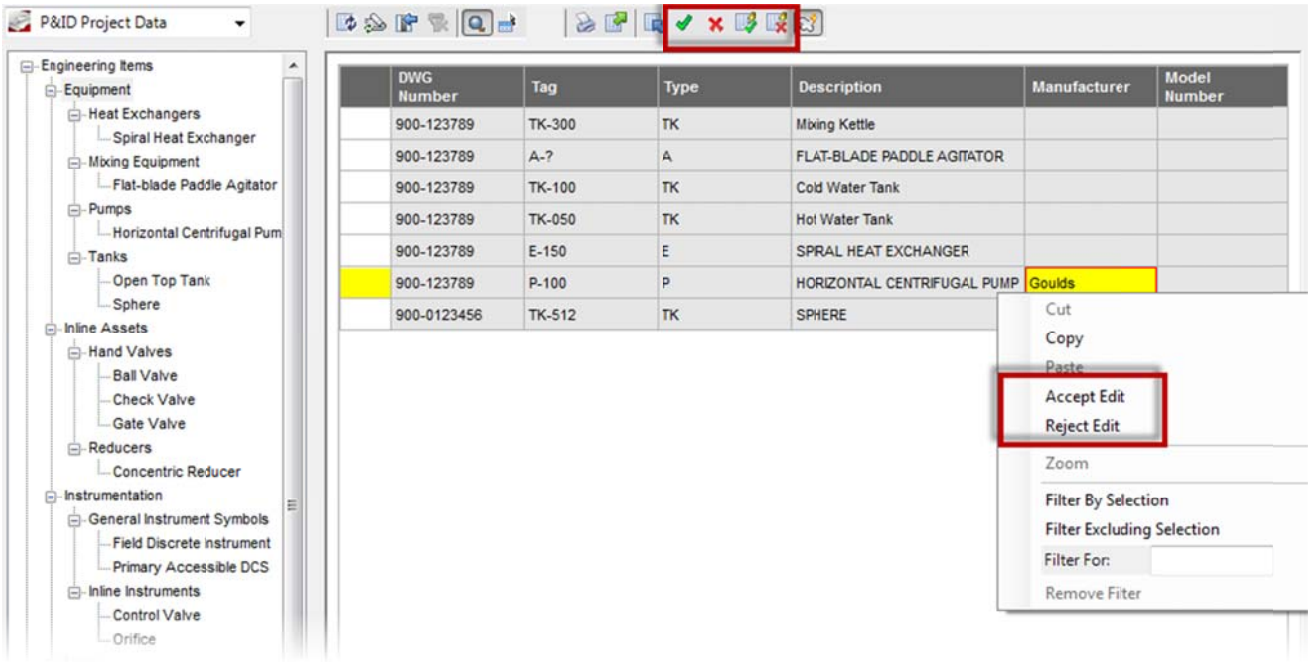
Export to Excel

Sometimes other people need to have input on what data is associated with items in your P&ID. AutoCAD P&ID allows you to export data from the Data Manager to an Excel spreadsheet which can be modified by others and imported back into your drawing through the Data Manager. This can be either Project or Drawing specific data. When you import the spreadsheet, all changes will be highlighted and you have the opportunity to accept or reject the changes. You can accept/reject the changes one at a time or all at once.

In this exercise you will export data from the project, specific to primary line segments. You will add data to the spreadsheet in Excel, and then import the changes.

1. In the Data Manager make sure that you are looking at Project Data (check the dropdown).
2. Select Primary Line Segments and export  the line information (your project folder is probably a good destination for the export file).
3. Open Microsoft Excel and add information about the manufacturer, the supplier and some comments on each line.
4. When you have added information for each pipeline segment, save your spreadsheet and close Excel.
5. Return to AutoCAD P&ID and import  the updated spreadsheet. Look at the Data Manager. Each line that has a change is preceded by a yellow highlighted cell and every cell that has changed is highlighted. Notice, also, that when you mouse over a changed field, the previous value for that field shows in the tool tip, next to the cursor.

At this point you have the option to accept or reject each change (right-click on a modified cell) or use the tools at the top of the Data Manager.



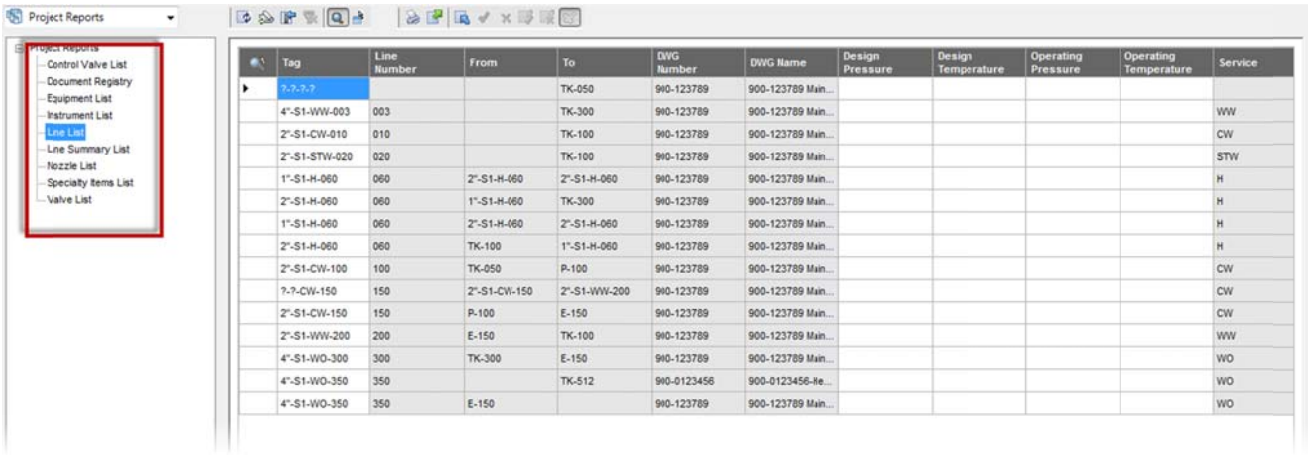
Try accepting some and rejecting others. Save your changes.

Reporting

As stated earlier, some data is better represented in a report rather than on a drawing. Since AutoCAD P&ID creates intelligent drawings and keeps the data in the drawing, you have access to many common reporting functions through the program interface. This will save you a lot of time counting pipelines for a line list!

In this exercise we will again export data, but in this case it will be formatted in a specific report type.

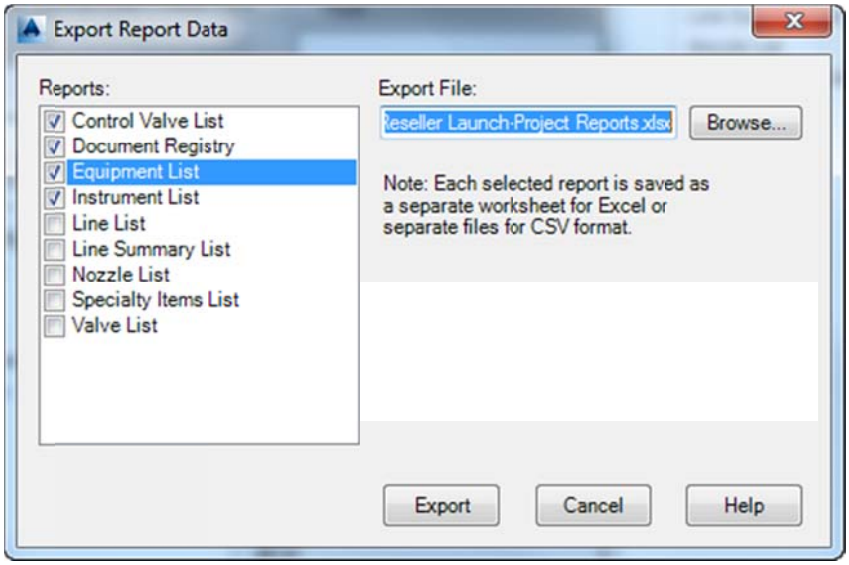
Make sure that your Data Manager is set to Project Reports (check the dropdown).



Tag	Line Number	From	To	DWG Number	DWG Name	Design Pressure	Design Temperature	Operating Pressure	Operating Temperature	Service
?-?-?-?			TK-050	910-123789	900-123789 Main...					
4"-S1-WW-003	003		TK-300	910-123789	900-123789 Main...					WW
2"-S1-CW-010	010		TK-100	910-123789	900-123789 Main...					CW
2"-S1-STW-020	020		TK-100	910-123789	900-123789 Main...					STW
1"-S1-H-060	060	2"-S1-H-060	2"-S1-H-060	910-123789	900-123789 Main...					H
2"-S1-H-060	060	1"-S1-H-060	TK-300	910-123789	900-123789 Main...					H
1"-S1-H-060	060	2"-S1-H-060	2"-S1-H-060	910-123789	900-123789 Main...					H
2"-S1-H-060	060	TK-100	1"-S1-H-060	910-123789	900-123789 Main...					H
2"-S1-CW-100	100	TK-050	P-100	910-123789	900-123789 Main...					CW
?-?-CW-150	150	2"-S1-CW-150	2"-S1-WW-200	910-123789	900-123789 Main...					CW
2"-S1-CW-150	150	P-100	E-150	910-123789	900-123789 Main...					CW
2"-S1-WW-200	200	E-150	TK-100	910-123789	900-123789 Main...					WW
4"-S1-WO-300	300	TK-300	E-150	910-123789	900-123789 Main...					WO
4"-S1-WO-350	350		TK-512	910-0123456	900-0123456-Re...					WO
4"-S1-WO-350	350	E-150		910-123789	900-123789 Main...					WO

The highlighted list, above, shows the default report types. You can also create custom report templates. This procedure is detailed in the help files.

1. Highlight (click on) Project Reports and click on the Export tool. 3 Mark the checkbox for each of the following report types:
   - Control Valve List
   - Document Registry
   - Equipment List
   - Instrument List



2. Open the report in Excel. Notice that each list has become a sheet in the Excel file.
3. Change or add some information on the different sheets and save the file.
4. Return to AutoCAD P&ID and make sure that you are still in Project Reports mode.
5. Import the Report Exercise.xls and notice that AutoCAD P&ID shows the changes per line and field (just like we saw in the data view export/import exercise). Of course, you have the option to accept or reject the changes one at a time or all at once.
6. Save the drawing we may want to use it later in this course.

Appendix B Glossary of P&ID Terms

Glossary

Term	Definition
Alarm	A device or *function* that signals the existence of an abnormal condition by means of an audible or visible discrete change, or both, intended to attract attention.
Assignable	A term applied to a feature permitting the channeling (or directing) of a signal from one device to another without the need for switching, patching, or re-wiring.
Auto-Manual Station	Synonym for control station.
Balloon	Synonym for *bubble.*
Behind the Panel	A term referring to devices that are not *accessible* for the operator's normal use, as opposed to devices designated as *local* or front-of-*panel-mounted*. In a very broad sense, "*behind the panel*" is equivalent to "not normally *accessible* to the operator."
Binary	A term applied to a signal or device that has only two discrete positions or states. When used in its simplest form, as in "*binary* signal" (as opposed to "*analog* signal"), the term denotes an "on-off" or "high-low" state, i.e., one which does not represent continuously varying quantities.
Bubble	The circular symbol used to denote and identify the purpose of an *instrument* or *function*. It may contain a tag number. Synonym for *balloon*.
Computing Device	A device or *function* that performs one or more calculations or logic operations, or both, and transmits one or more resultant output signals. A *computing device* is sometimes called a computing *relay*.
Configurable	A term applied to a device or system whose functional characteristics can be selected or rearranged through programming or other methods. The concept usually excludes re-wiring as a means of altering the configuration.
Controller	A device having an output that changes to regulate a controlled variable in a specified manner. A *controller* may be a self-contained analog or *digital instrument*, or it may be the equivalent of such an *instrument* in a shared-control system. An automatic *controller* varies its output automatically in response to a direct or indirect input of a measured process variable. A manual *controller* is a *manual loading station*, and its output is not dependent on a measured *process variable* but can be varied only by manual adjustment. A *controller* may be integral with other functional elements of a control *loop*.
Control Station	A *manual loading station* that also provides switching between manual and automatic control modes of a control *loop*. It is also known as an *auto-manual station*. In addition, the operator interface of a *distributed control system* may be regarded as a *control station*.
Control Valve	A device, other than a common, hand-actuated ON-OFF valve or self- actuated check valve that directly manipulates the flow of one or more fluid process streams. In general, use of the designation "*hand control valve*" is limited to hand-actuated valves that (1) are used for process throttling, or
Converter	A device that receives information in one form of an instrument signal and transmits an output signal in another form. An instrument that changes a sensor's

	output to a standard signal is properly designated as a transmitter, not a converter. Typically, a temperature element (TE) may connect to a transmitter (TT), not to a converter (TY).
Detector	Synonym for *sensor*.
Digital	A term applied to a signal or device that uses binary digits to represent continuous values or discrete states.
Distributed Control System	A system, which while being functionally integrated, consists of subsystems, which may be physically separate and remote from one another.
Final Control Element	The device that directly controls the value of the manipulated variable of a control loop. Often the final control element is a control valve.
Function	The purpose of, or an action performed by, a device.
Instrument	A device used directly or indirectly to measure and/or control a variable. The term includes primary elements, final control elements, computing devices, and electrical devices such as annunciators, switches, and push buttons. The term does not apply to parts (e.g., a receiver bellows or a resistor) that are internal components of an instrument.
Instrumentation	A collection of instruments or their application for the purpose of observation, measurement, control, or any combination of these.
Local	Designates an instrument, controller, or control station which is installed in the vicinity of the component or device which it affects, as opposed to one mounted in a remote panel or control station. The word “field” is often used synonymously with local.
Manual Loading Station	A device or function having a manually adjustable output that is used to actuate one or more remote devices. The station does not provide switching between manual and automatic control modes of a control loop (see controller and control station). The station may have integral indicators, lights, or other features. It is also known as a manual station or a manual loader.
Measurement	The determination of the existence or the magnitude of a variable parameter.
Monitor	A general term for an instrument or instrument system used to measure or sense the status or magnitude of one or more variables. The term monitor is very unspecific as it can sometimes meaning analyzer, indicator, or alarm. Monitor can also be used as a verb.
Monitor Light	Synonym for pilot light.
Panel	A structure upon which are mounted a group of instruments, and which houses the operator-process interface. A panel may consist of one or several sections, cubicles, consoles, or desks. A synonym for board.
Panel-Mounted	A term applied to an instrument that is mounted on a panel or console and is accessible for an operator’s normal use. A function that is normally accessible to an operator in a shared-display system is the equivalent of a discrete panel-mounted device.
Pilot Light	A light that indicates which of a number of normal conditions of a system or device exists, as differentiated from an alarm light, which indicates an abnormal condition. The pilot light is also known as a monitor light.
Piping and Instrumentation Diagram (P&ID)	A schematic (diagrammatic) representation of the piping, ductwork, and equipment showing the physical/functional relationship among the various components for the purpose of depicting a given system’s flow, temperature,

	pressure and mass balance relationships.
Process Variable	Any property of a process that can be expected to change during the normal operation of the process.
Program	A repeatable sequence of actions that defines the status of outputs as a fixed relationship to a set of inputs.
Programmable Logic Controller	A controller, usually with multiple inputs and outputs, that contains an alterable program.
Relay	A device whose function is to pass on information in some modified form. Relay is often used to mean computing device. The term “relay” also is applied specifically to an electric, pneumatic, or hydraulic switch that is actuated by a signal. The term also is applied to functions performed by a relay.
Scan	To sample, in a predetermined manner, each of a number of variables intermittently. The function of a scanning device is often to ascertain the state or value of a variable. The device may be associated with other functions such as recording and alarming.
Sensor	That part of a loop or instrument that first converts the value of a process variable into a corresponding, predetermined, and intelligible state or output. The sensor may be separate from or integral with another functional element of a loop. The sensor is also known as a detector or primary element.
Set Point	An input variable that sets the desired value of the controlled variable. A set point may be manually set, automatically set, or programmed. Its value is usually expressed in the same units as the controlled variable.
Shared Controller	A *controller* containing preprogrammed algorithms that are usually *accessible, configurable,* and *assignable*. It permits a number of *process variables* to be controlled by a single device.
Shared Display	The operator interface device (commonly a video screen) used to display process control information from a number of sources at the command of the operator.
Switch	A device that connects, disconnects, selects, or transfers one or more circuits and is not designated as a *controller*, a *relay*, or a *control valve*. As a verb, the term is also applied to the *functions* performed by switches.
Test Point	A process connection to which no *instrument* is normally connected, but which is intended for the temporary or intermittent connection of an *instrument*.
Transducer	A general term for a device that receives information in the form of one or more physical quantities, modifies the information and/or its form, if required, and produces a resultant output signal, usually electric. Depending on the application, the transducer can be a *primary element, transmitter, relay, converter* or other device. Because the term “transducer” is not specific, its use for specific applications is not recommended.
Transmitter	A device that senses a *process variable* through the medium of a *sensor* and has an output whose steady-state value varies only as a predetermined *function* of the *process variable*. The *sensor* may or may not be integral with the transmitter. Transmitters frequently convert physical input process signals into electrical outputs.

Appendix C

Glossary of Application Terms

Term	Definition
Acquire mode	The mode in which a property acquires its value from another source (properties for a project, drawing, or class). See also Override mode and Initialization only.
Acquisition	A property type that acquires its value from another source such as project properties, drawing properties, or class properties.
Annotation	An AutoCAD object comprised of text and (optional) shapes. In AutoCAD P&ID, annotations are used to display data values of P&ID components (including equipment, valves, lines, and so on). These values are displayed as text.
Assembly	A group of connected components that are commonly placed in a drawing at the same time. For example, a level gauge assembly might contain an instrument and five valves. You can place an assembly from a tool palette instead of selecting each component individually.
Assumed nozzle	A type of nozzle that is automatically added as a record in the Data Manager when a pipe line is connected to a piece of equipment. Unlike other nozzle types, an assumed nozzle is not visible in the drawing.
Automatic annotation	A type of annotation that gets automatically inserted when a component is created. See also Annotation and Linked Annotation.
Child table	*See* Object table.
Class	A specific type of a class, as opposed to a class family. For example, Centrifugal Pump is a class from the Pumps class family.
Class family	A class that is used to categorize other classes and set a starting point for class properties, tags, and annotations for those classes. For example, Pumps and Equipment are class families; Centrifugal Pump and Ball Valve are classes.
Class property	A property of a class; it reflects a data value. For example, the Hand Valve class type may have attributes of size, spec, and manufacturer. The Pumps class type may have flow, TDH, and manufacturer.
Component	A native AutoCAD P&ID object type. AutoCAD P&ID components include Equipment, Nozzles, Lines, Instruments, and Inline components.
Component class	*See* Class.
Connection symbol	The graphical element in a drawing that indicates an off-page or on-page line connection. You can choose from several symbols.
Convert	To change an AutoCAD object to an AutoCAD P&ID component or line; the converted item is included in data reports.
Data Manager	An enhanced secondary window in AutoCAD P&ID; it displays data in a table.

DWF (P&ID)	A Design Web Format file; it is a compressed file format created from DWG files in a project. DWF files are easy to publish and view on the Web.
Equipment InfoTag	An annotation style. A multiline set of attributes that displays selected data values for a placed piece of equipment. One Equipment InfoTag for each equipment component is typically placed at the top of a drawing or in a grid across the bottom of the drawing.
Family table	A table that contains information about different classes within a class family. For example, the Equipment family table contains information about pumps, tanks, blowers and other classes found under the Equipment class family.
Flag	A symbol, like an arrow, that indicates the direction of the flow. The flag symbol contains the line number annotation. It is on the Non-engineering tab of the P&ID DIN tool palette.
Flip grip	A grip that flips an object in the direction the cursor is moved.
Flow arrow	The direction in which a schematic line flows. You can control the direction of the flow arrow using dynamic grips.
Freestanding annotation	Text that is associated with a component; it does not move when the component moves. However, the data associated with the annotation updates with the component. Just the text gets disconnected. Annotations are either free-standing or linked. See also Linked Annotation.
Gap crossing	A visual indication on a drawing that a line breaks on either side of a crossing.
Initialization only	A property setting that limits property acquisition to a one-time event, when a component is first initialized. If the property is set to initialization only, it acquires its value from its designated source and changes immediately to override mode. See also *Acquisition and Override mode.*
Inline component	A component with an alignment grip that can be dropped onto a line.
Instrument	A device or combination of devices used directly or indirectly to measure, display, or control a variable.
KKS (Kraftwerks-Kennzeichen-System)	A power plant classification system managed and developed by VGP Working Panel. KKS is usually used with the DIN 24081 standard.
Linked annotation	Graphic, text, or text with a graphic that labels a component. The text values reflect the data attribute values of a component. Examples of linked annotations are a line ID, a valve size, instrument function symbol, or Equipment InfoTag. Linked annotation moves when the component moves.
Loop crossing	A visual indication on a drawing that a line loops over another line.
Object table	A table that contains specific information about a class or a property of a class. For example, Pumps is an object table of the Equipment family table.
Off-page connector	The graphical representation on a P&ID drawing of the continuance of a line from one project drawing to another.
Orthogonal	The default AutoCAD P&ID schematic line behavior of connecting at 90-degree

connection	increments.
Override mode	A mode in which an acquired property can be modified. A property that is set up to acquire its value from another source is switched from acquiring mode to override mode in the Properties palette or in the Data Manager. See also *Acquiring mode*.
Pins	Symbols that identify a change in a pipe line property. In the KKS tagging standard, pins identify a change in properties (for example, Unit Number or System Code). A pin is either open (no-fill) or closed (black fill). Open pins mark the boundaries of a group with a common property. Closed pins identify a break in piping sub-systems or branches in a pipe line. When using either open or closed pins, drafters must manually change the properties of the lines beyond the open-pin boundary. Pins are located on the Non-engineering tab of the DIN tool palette.
Schematic line	A line in AutoCAD P&ID that represents pipe lines and signal lines.
Tag	A property that uniquely identifies a component in a project.
Trim	As a verb, to add hardware to a piece of equipment. As a noun, additional information. A pipe trim is additional information (text or graphics) to further define a piping segment. Equipment trim is additional information (text or graphics) to further define a piece of equipment.
Validate	To check a drawing or a project for errors and inconsistencies such as unconnected components, non-terminating lines, and so on.