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P&ID

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P&ID DesignValidation Overview

P&ID DesignValidation is a ShipConstructor product for comparing and identifying discrepancies between the 3D model developed in the ShipConstructor environment and a set of piping and instrumentation diagrams developed in the AutoCAD P&ID environment. The benefit of the P&ID DesignValidation product is that it serves as an efficient instrument for ensuring consistency between the original design captured in P&ID diagrams and the ShipConstructor 3D model built based on the design. The instrument allows the user to define flexible mapping rules to describe the relationship between the ShipConstructor and P&ID project. Once the relationship is defined, an automatic comparison function can be run to reveal discrepancies between the two projects. The types of discrepancies identified by P&ID DesignValidation include missing, duplicate, and inconsistently matching assets; and differences in the pipe-system connectivity network.

Terms and Definitions

It is recommended that before continuing reading this manual, the following terms and definitions are understood.

Asset

The “Asset” is a broad term that may be applicable to a variety of objects inside a P&ID diagram. An asset may be a piece of equipment, a pipe fitting, a reducer, a valve, a nozzle, or other type of a physical part. The key requirement for an object to be considered an asset is that the object plays a distinct role in the piping process captured in the P&ID diagram. For example, assets such as reducers modify the flow; valves control the flow, and pumps create the flow. In AutoCAD P&ID, most assets are uniquely identified by their “Tag” property; however, there are cases where an asset can be defined as "not a tagged component." For example, in the default AutoCAD P&ID configuration, reducers do not have tags. AutoCAD P&ID separates assets into several categories. Depending on how an asset connects to a pipe line, the asset can be classified as endline, inline, segment breaker, segment group breaker, or no-join asset.

AutoCAD P&ID

AutoCAD P&ID is an AutoCAD-based Autodesk product for creating, editing, and managing piping and instrumentation diagrams.

Comparison Equation

The “comparison equation” is an informal term that is occasionally used throughout this manual to describe a scenario where a P&ID project is compared against a ShipConstructor project. The rationale behind using the word "equation" is related to the goal pursued by P&ID DesignValidation users. In many cases, the goal is to achieve the state of equality between the P&ID and ShipConstructor side.

Comparison Property

The “comparison property” is an object attribute that is linked to another object attribute on the opposite side of the comparison equation via a mapping rule. Note that for a property to be considered a comparison property, the “Identifier” checkbox should not be checked when the related mapping rule is introduced. Typically, comparison properties are used for evaluating the quality of the match between P&ID and ShipConstructor entities that have

already been identified as corresponding entities. By looking at comparison properties, users are able to see how closely one entity matches with the other.

Identifier Property

The “identifier property” is an object attribute that is linked to another object attribute on the opposite side of the comparison equation via a mapping rule. Note that for a property to be considered an identifier property, the “Identifier” checkbox must be checked when the related mapping rule is introduced. Identifier properties tell what the entities are. In P&ID DesignValidation, it is permissible to combine more than one identifier property to isolate an entity. For example, pipe-line entities may be recognized based on unique combinations of the Line Number and Pipe Size rather than a single property only. The same idea applies to assets; however, having more than one property for assets is usually unnecessary. When comparing entities from the P&ID and ShipConstructor sides, a pair of entities will be considered corresponding (matching) if values of all identifier properties on one side of the comparison equation are the same as on the other side.

Line

A pipe line is an entity represents a process occurring among several assets in the P&ID diagram. For example, a pipe line can transport raw water from a storage container to a boiler, or transport gasoline from a fuel tank to the main engine. From the broadest perspective, lines are links among different assets in the P&ID diagram.

In AutoCAD P&ID, all pipe lines are arranged into a system of *pipe line segments* and *pipe line groups*. A pipe line segment is the smallest building block representing a portion of a P&ID process. The way pipe line segments are combined into groups is via an association with the group’s tag property that identifies the group. AutoCAD P&ID requires that values of all pipe-line-group tags are unique.

Mapping Rules

Mapping rules are the collection of user-defined rules that tell what the relationship between object properties on one side of the comparison equation and object properties on the other side of the comparison equation is. Without having mapping rules defined, performing the data comparison or data extraction operation is not possible.

Mapping rules serve two different functions. First, they help map properties of P&ID objects to properties of ShipConstructor objects; and, second, they define which properties are identifier properties and which properties are comparison properties.

A classic example of a mapping rule would be the link between the tag property of a P&ID asset and a UDA assigned to a piece of equipment modeled in a ShipConstructor model drawing.

Piping and Instrumentation Diagram

Piping and instrumentation diagrams, or P&ID diagrams, are schematic representations of processes occurring in piping systems that link various pieces of equipment and instrumentation together. P&ID diagrams usually include the following elements: pipe lines, instrumentation lines, equipment, valves, and some types of fittings. Individual pipe parts that are not assigned with unique roles are usually not shown in the P&ID diagram.

Service

The Service is a non-unique property of a pipe line group that describes the general function that the pipe line group serves. AutoCAD P&ID has a default list of Services available in the new project that can be reconfigured by the user as necessary. The default list of services includes Raw Water, Seal Oil, Oxygen, and others.

Tag

The tag is a fundamental term used in piping and instrumentation diagrams. Essentially, the tag is a property that may identify assets, pipe line groups, and pipe line segments in a diagram. For assets and pipe line groups, tags are expected to have unique values across the AutoCAD P&ID project. For pipe line segments, tags are expected to be unique across different pipe line groups but may reoccur within the same group.

AutoCAD P&ID allows users to define custom tag formats consisting of a single or multiple properties at a time. In general, the process of defining a tag is similar to that of defining a ShipConstructor naming convention. The user chooses which properties to include into the expression, which strings to use as separators, and which numeric counters to add to the tag.

The user can display tags in the drawing as annotations or read tags directly from OPM. Overall, AutoCAD P&ID has a very flexible system for working with tag formats and annotations. It is recommended that the user studies P&ID documentation to learn about the wide range of possibilities the platform offers.

License Requirements

To be able to run P&ID DesignValidation commands, the user needs to ensure that one of the following licensing requirements has been met:

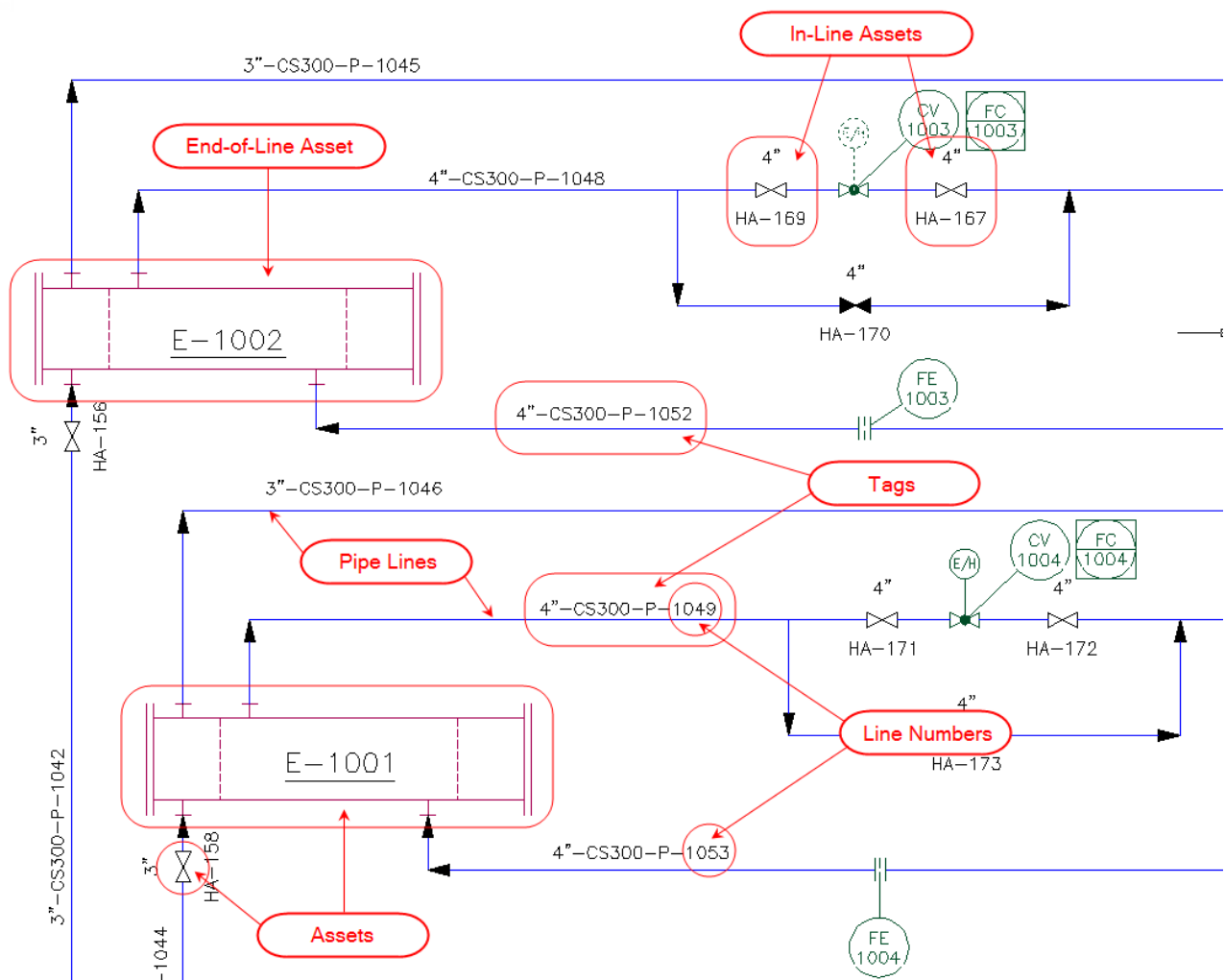
- Universal License; or
- P&ID DesignValidation License combined with the Pipe License.

Note that the P&ID DesignValidation license does not have any levels and does not impose any restrictions on the maximum number of parts that the user can have in the ShipConstructor project. The maximum number of modeled ShipConstructor pipe parts and equipment is only indirectly controlled by the Pipe license.

Also note that no restrictions apply to the AutoCAD P&ID side. In AutoCAD P&ID, the user may have as many assets and pipe lines as it is necessary.

Explanation of P&ID Diagram

The diagram below provides a quick explanation of major elements that can be found in a P&ID diagram.



In the diagram, the blue lines represent pipe lines. For example, one may see pipe lines with the following numbers: 1042, 1045, 1046, 1048, 1049, 1052, and 1053. A pipe line number can be learned from the annotation that the user ordinarily places next to the pipe line.

In a P&ID diagram, a typical pipe line annotation may look as follows: 4"-CS300-P-1049. Similar to tags, annotations are constructed of components such as individual object properties. An annotation may include multiple fields representing different properties such as the tag, size, service, spec, line number, or others. In the above diagram, all annotations are setup to display direct values of tags. Note, however, that this is not the only possible setup in the flexible AutoCAD P&ID environment. Annotations can be any; and they do not have to be unique. Moreover, users may define multiple annotation formats associated a given P&ID class definition. Later, the user may choose which specific format to use at a particular location in the diagram.

In the above diagram, pipe line annotations communicate four important bits of information encoded in the tag property. For example, the 4"-CS300-P-1049 annotation tells that the size of the pipe line is 4", the spec is CS300, the service is P, and the line number is 1049.

By studying the diagram above, one may observe that blue lines representing pipe lines typically emerge from an object and finish at an object. Sometimes, lines may also "carry" objects in the line. As it has already been mentioned in "Terms and Definitions" section of this manual such objects are called "assets."

There are several types of assets in the P&ID diagram: end-of-line, in-line, no-join, and segment breakers. The above diagram only shows two of these types of assets: end-of-line and in-line assets. An end-of-line asset would be an exchanger, E-1001 or E-1002. An in-line asset would be a valve, HA-171, HA-172, or HA-173. Regarding not shown assets, a typical segment breaker would be a reducer, and a typical no-join asset would be a standalone piece of equipment that cannot form connections with pipe lines.

The biggest difference between end-line and in-line assets is that the former acts as the origin or the destination of a piping process while the latter acts as a variation of the process. If the user removes an end-line asset from a P&ID diagram, the user will destroy the process. For example, taking a pump out of a P&ID diagram may leave the "To" and "From" properties blank for some of the pipe line segments. This would mean that unattached pipe line segments no longer describe the process between the origin and the destination.

On the other hand, if the user removes an in-line asset from a diagram, the user may lose some degree of control over a process, but the process will still remain. For example, taking a valve out a P&ID diagram still preserve the process between the origin and the destination. The only difference it makes is that the user is no longer able to control the flow between the two end-line assets.

In addition to piping elements, P&ID diagrams may contain special symbols that show instrumentation. For example, green elements in the above diagram are instruments. Instruments can be the following types of asset class definitions: restriction orifices, rotameters, volume meters, turbines, vortex sensors, pressure release valves, Pitot tubes, venturies, and many others.

Sometimes, the difference between piping assets and instrumentation assets is subtle, but sometimes, it is more obvious. Compared to piping assets such as a standard 4" butterfly valve, instruments are more complex and diverse in their qualities. For example, instruments may include various electronic components. Also, the choice of an instrument at a particular location may depend on multiple operating conditions such as the flow speed, pressure, and temperature.

Workflow

The following section describes a basic twelve-step workflow that covers every aspect of using P&ID DesignValidation. The benefit of knowing the standard workflow is that it helps to understand of the full range of possibilities provided by the tool. In practice, however, users may choose to adjust their individual workflow to their needs.

The steps below are arranged in the logical order in which actions are likely to be performed:

[Step 1: Plan for Comparability](#) (page 7)

[Step 2: Setup AutoCAD P&ID Project](#) (page 10)

[Step 3: Complete P&ID Diagram](#) (page 13)

[Step 4: Setup ShipConstructor Project](#) (page 14)

- [Step 5: Define Mapping Rules](#) (page 16)
- [Step 6: Create 3D Model in ShipConstructor](#) (page 19)
- [Step 7: Extract Data from P&ID and ShipConstructor Projects](#) (page 20)
- [Step 8: Run P&ID DesignValidation Comparison](#) (page 21)
- [Step 9: Access P&ID DesignValidation Commands Directly](#) (page 25)
- [Step 10: Review Comparison Results](#) (page 25)
- [Step 11: Investigate Individual Cases](#) (page 27)
- [Step 12: Fix Discrepancies](#) (page 29)

The twelve sections that follow provide a detailed discussion of each step.

Step 1: Plan for Comparability

Before proceeding to modeling the project in either ShipConstructor or AutoCAD P&ID environment, it is generally beneficial to spend some time on planning for future comparability between the P&ID and ShipConstructor projects. The nature of the P&ID DesignValidation product is such that doing some planning at an early stage of the project can bring significant benefits later.

It is recommended that at the planning stage, the user considers of the following questions:

- Which properties should be used as unique identifiers of assets and pipe lines on both sides of the comparison equation?
- Should object identifiers rely on single properties or combinations of several properties?
- Which properties should be mapped together as comparison properties for pipe lines and for assets?
- Will it be feasible to fill in values of identifier and comparison properties consistently for all objects on both sides of the comparison equation?
- Is there a potential for having some properties populated with values automatically?
- Values of which properties will have to be typed in manually?
- What can be done to simplify manual work when typing in property values manually? Can values themselves be simplified?
- What is the best way to organize the Spec-System-Branch tree in ShipConstructor so that pipe systems are easily comparable against the P&ID side?

While each of the questions above can have more than one right answer, a few relatively standard and recommended solutions are discussed below.

Identifier Properties for Assets

AutoCAD P&ID offers a built-in functionality for uniquely identifying assets by their tags. The recommendation is to leverage this already existing functionality as part of the P&ID DesignValidation workflow.

For example, to make the comparison between the P&ID side and the ShipConstructor side possible, users are recommended to map P&ID tags to ShipConstructor UDAs that act as tags on the ShipConstructor side. Values of ShipConstructor UDAs should be filled manually to be consistent with P&ID tags. Due to manual assignment of UDA values, it is also recommended that the user keeps asset tags short and simple to minimize the number of typing mistakes.

Identifier Properties for Pipe Lines

Choosing identifier properties for pipe lines that come from different sides of the comparison equation may be a more complex problem to solve than choosing identifier properties for assets. One reason is that pipe lines are complex entities consisting of variable numbers of subcomponents that may not be the same on the P&ID and ShipConstructor side. Another reason is that on the ShipConstructor side, pipe lines may include hundreds of pipe parts and fittings, which makes it impractical to have tags as UDAs assigned to each modeled part.

Under such condition, the user may find it rational to rely on group properties while working with pipe systems as if they are collections of objects rather than isolated parts. The exact selection of identifier properties would depend on objectives the user wants to achieve. For example, if an objective is to confirm that all pipe lines that exist on the P&ID side correctly appear on the ShipConstructor side, a single Line Number property may be chosen as a pipe line identifier on the P&ID side. A corresponding property on the ShipConstructor side may be the Branch Name in this case.

It is important to understand that when it comes to complex entities such as pipe lines, the choice of specific identifier properties predetermines the way the entire piping system is subdivided into comparable portions. For example, if only a single identifier property is used, the piping system will be broken into portions based on different values of that property alone. However, if the user applies a combination of two or more identifier properties at a time, the piping system will be subdivided into portions based on unique combinations of values of several properties taken at a time. The latter setup is likely to produce a larger number of smaller-size comparable entities.

Example

The next example explains how the mechanics works in practice when the user introduces identifier properties for pipe lines. As the initial state, let's assume that the current project has two piping systems that are represented by three pipe lines compounded of pipe parts of different sizes. For the purpose of this explanation, it is not very important if the current project is a P&ID or a ShipConstructor one. The logic works identically on both sides of the comparison equation.

	System A	System B
Line 001	Pipe 100mm Pipe 120mm	
Line 002	Pipe 100mm Pipe 100mm	
Line 003		Pipe 120mm Pipe 120mm

If Line Number is used as the only identifier property, the dataset above will be subdivided into the following groups:

Line 001	Line 002	Line 003
Pipe 100mm Pipe 120mm	Pipe 100mm Pipe 100mm	Pipe 120mm Pipe 120mm

If the user chooses the System property to be the only identifier property, the breakdown into comparable groups will look as follows:

System A	System B
Pipe 100mm (Line 001) Pipe 120mm (Line 001) Pipe 100mm (Line 002) Pipe 100mm (Line 002)	Pipe 120mm (Line 003) Pipe 120mm (Line 003)

If the user chooses the Pipe Size property to be the only identifier property, the groups will look as follows:

Size 100mm	Size 120mm
Pipe 100mm (Line 001)	Pipe 120mm (Line 001)
Pipe 100mm (Line 002)	Pipe 120mm (Line 003)
Pipe 100mm (Line 002)	Pipe 120mm (Line 003)

Finally, if the user chooses the Line Number and Pipe Size to be a combination of two identifier properties, the pipe system will be split into the following four groups based on different combinations of values:

Line 001 & Size 100mm	Line 001 & Size 120mm	Line 002 & Size 100mm	Line 003 & Size 120mm
Pipe 100mm	Pipe 120mm	Pipe 100mm	Pipe 120mm
		Pipe 100mm	Pipe 120mm

Sample Setup of Identifier and Comparison Properties for Pipe Lines

Unfortunately, there is no single universally applicable method to set up identifier and comparison properties for pipe lines in P&ID and ShipConstructor projects. Depending on the specifics of a particular project, some setups may work better than the other.

The purpose of this section is to discuss a basic setup that a person without extensive knowledge of AutoCAD P&ID can implement. The basic setup assumes minimum modifications to the default configuration of Project Settings in AutoCAD P&ID. The majority of adjustments are expected to take place on the ShipConstructor side to accommodate for the project structure on the AutoCAD P&ID side.

Identifier Properties

In its default configuration, an AutoCAD P&ID project uses the Line Number property as the only component in the pipe-line-group tag definition. Because tags are expected to be unique for different groups, this implies that all Line Numbers will be unique across the entire project. The uniqueness will be enforced by the AutoCAD P&ID platform.

In the default configuration, Line Number is the only unique identifier that applies to pipe lines. Unless the user wants to reconfigure the project, the user will have to rely on the Line Number to establish correspondence between P&ID pipe lines and ShipConstructor pipe parts.

The recommendation is to link the P&ID Line Number to the ShipConstructor “BranchName” property. To make the link working, the user should make sure that all pipe branches in the ShipConstructor Systems Manager (SCPIPESYSMANAGER) have exactly the same names as Line Numbers in the P&ID project. Then, the user will need to create a mapping rule that links P&ID “LineNumber” to ShipConstructor “BranchName.” Managing mapping rules is discussed later in this manual.

Comparison Properties

In addition to the identifier properties, the user might want to define a few comparison properties for pipe lines. Some understanding of how P&ID properties are organized may be beneficial when deciding which properties to compare.

For example, besides Line Number, pipe line groups are described by their non-unique properties such as Service assignment, Nominal Size, and Nominal Spec that apply at the group level. All of group properties are inherited by individual pipe line segments belonging to that group. Individual pipe line segments cannot override values of group properties, so the entire collection of pipe line segments shares the same Line Number, Service, Nominal Size, Nominal Spec, and other group properties.

There are, of course, some properties that apply to pipe line segments individually without affecting the group properties. For example, Size, Spec, Insulation, Test Pressure, and other properties can be specified for each pipe segment individually.

Based on the way P&ID properties are organized, the following relationships between comparison properties are recommended: the pipe-line-group Service can be compared against the ShipConstructor System; the pipe-line-segment Size can be compared against the ShipConstructor Outer (Inner) Diameter; the pipe-line-segment Spec can be compared against the ShipConstructor Spec.

Summary

The table below summarizes a possible basic setup:

Property Type	P&ID Side	ShipConstructor Side
Identifier	LineNumber	BranchName
Comparison	Service	SystemName
Comparison	Spec	SpecName
Comparison	Size	OuterDiameter / InnerDiameter

General Remarks on Comparison Properties

There are no strict rules that prescribe which properties to use as comparison properties for assets and pipe lines. In essence, any two properties from different sides of the comparison equation that are similar in their physical meaning can be compared against each other.

The key requirements when selecting comparison properties and introducing mapping rules for them are:

- Mapped properties should be identical in their physical meaning. For example, if the user knows that the P&ID Size property is an equivalent of the Inner Diameter property on the ShipConstructor side, mapping this property to the Outer Diameter property will be incorrect.
- Mapped properties should use the same measurement scale. For example, mapping a numeric value expressed in thousands of units to a similar numeric value expressed in tens of thousands of units will be incorrect.
- Mapped properties should use the same measurement system. For example, mapping imperial sizes to metric sized will be a mistake.
- If values of mapped properties are recorded as unconstrained text, users need to make sure that the text entered on both sides of the comparison equation is identical. A single spelling mistake will result in an inconsistency. Note, however, that minor differences in spelling such as letter capitalization or presence of space characters in the beginning or the end of a word are ignored by the comparison mechanism.

Step 2: Setup AutoCAD P&ID Project

This section discusses possible adjustments that the user can apply on the AutoCAD P&ID side to ensure that ShipConstructor and P&ID projects are structured similarly and comparable against each other. Based on practical experience, it is highly recommended that most adjustments are made before actual diagrams are modeled in AutoCAD P&ID. Otherwise, it may take more effort to introduce changes later.

In general, AutoCAD P&ID offers a very flexible environment for customizing individual class definitions. Users are able to supplement default class definitions with additional properties, a concept similar to User-Defined Attributes (UDAs) in ShipConstructor. Users are also given the ability to organize object definitions as trees where properties assigned to upper-level classes get inherited by lower-level items, a concept similar to ShipConstructor equipment. Finally, AutoCAD P&ID opens limitless opportunities for configuring asset and pipe line tags, a concept similar to ShipConstructor naming conventions.

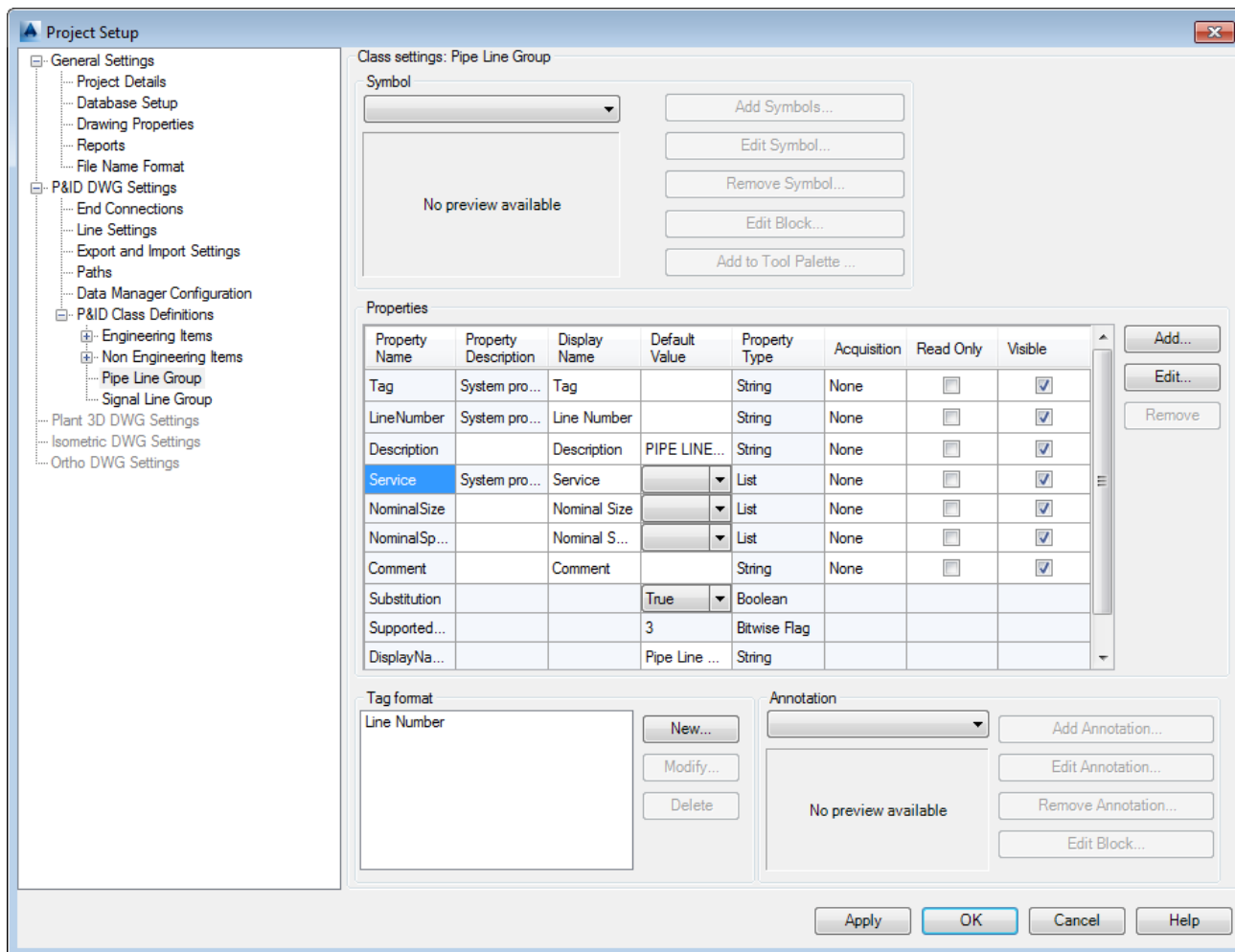
Overall, the more proficient the user becomes with AutoCAD P&ID, the more flexible setup he or she will be able to create. A thoughtful P&ID setup can make a real difference when running comparison operations between AutoCAD P&ID and ShipConstructor.

Changing Values of Services

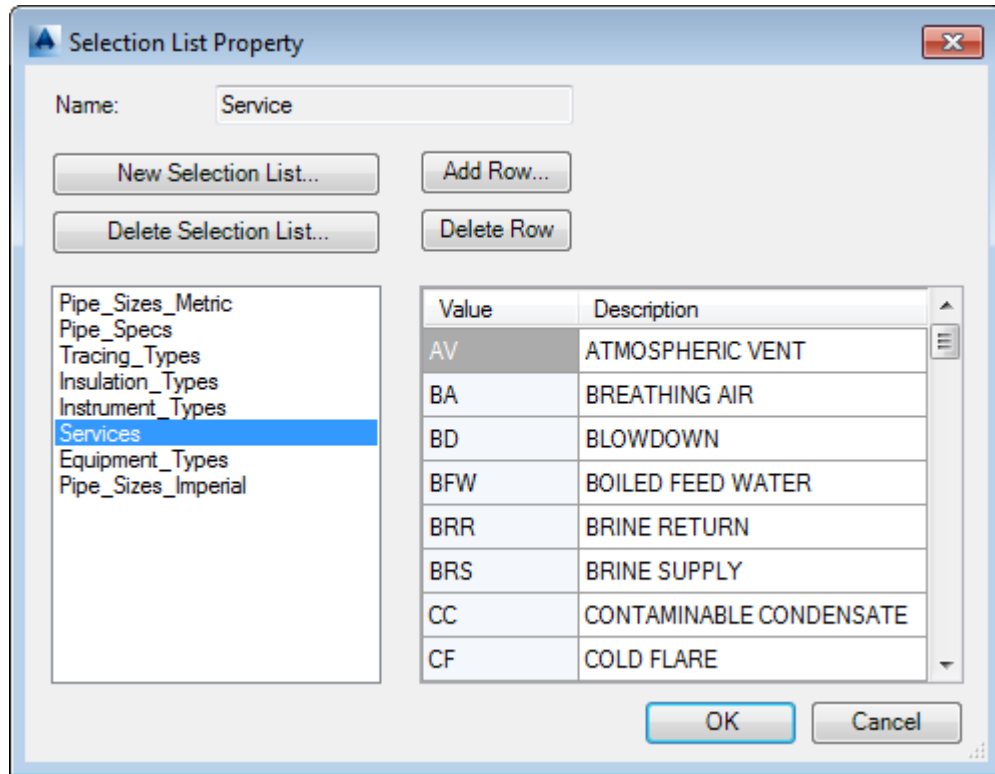
In its default configuration AutoCAD P&ID comes with a predefined set of pipe services. The user may choose to rename some of the P&ID services to make them consistent with ShipConstructor systems in case the two properties are mapped to each other.

The following steps can be used to redefine services in AutoCAD P&ID:

1. In Project Manager, right-click the project name and select "Properties..." The "Project Setup" dialogue will open (see below);



2. In the "Project Setup" dialogue, use the tree on the left to select "Pipe Line Group";
3. In the area on the right, select the "Service" property and click the "Edit" button on the far right. The "Selection List Property" dialogue will open:

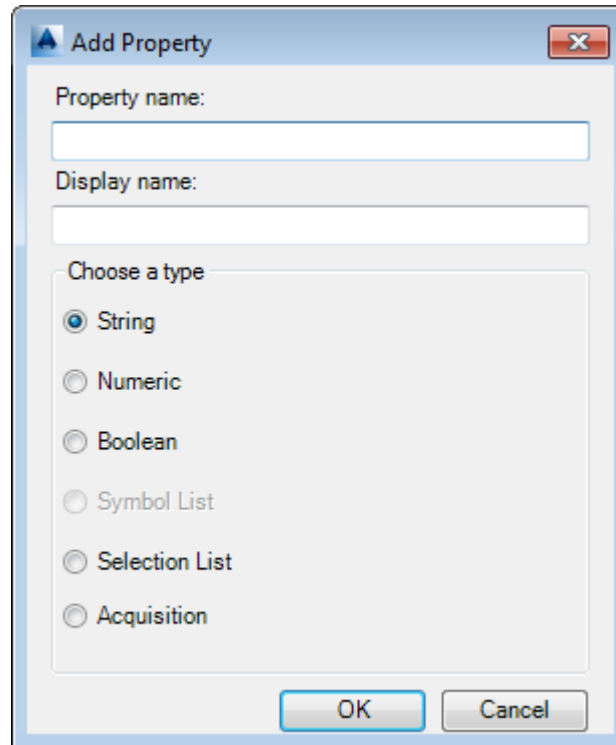


4. In the “Selection List Property” dialogue, delete not required services and enter new ones.

Adding Attributes

To add an attribute to a class, please follow the steps below:

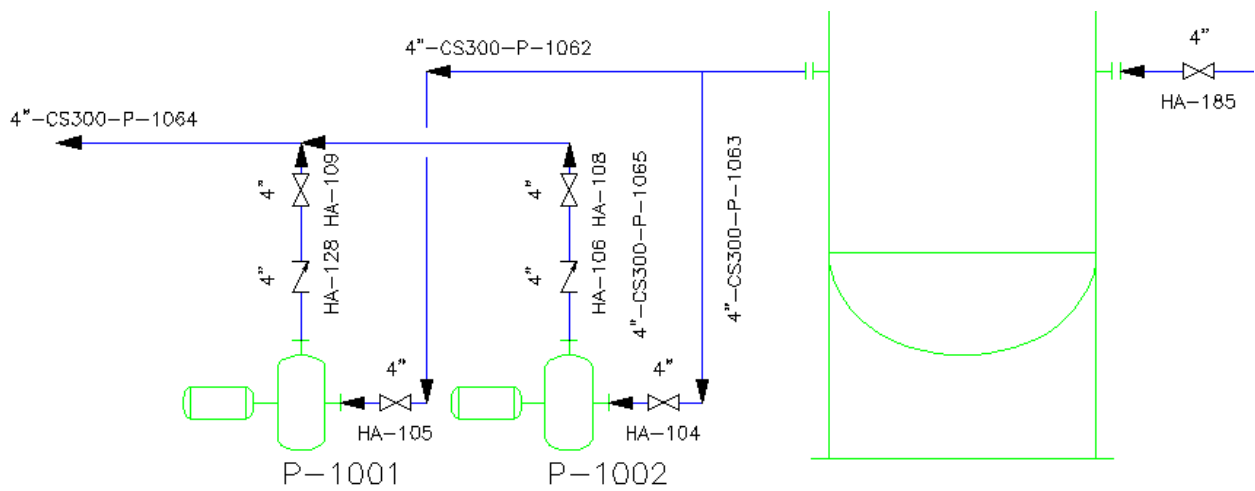
1. Open the “Project Setup” dialogue;
2. Select a class definition to which a new attribute should be added;
3. Click the “Add” button at the far right. The “Add Property” dialogue should open:



4. In the "Add Property" dialogue, enter the new property name and select the attribute type;
5. Depending on the choice of the type, follow a few more steps to complete the process.

Step 3: Complete P&ID Diagram

According to the main use case for P&ID DesignValidation, there is an expectation that the user completes P&ID diagrams before he or she proceeds to creating the 3D model in ShipConstructor. The rationale is that schematic diagrams capture the initial design while the ShipConstructor project captures the implementation.



Sample P&ID Diagram

Before an AutoCAD P&ID project can be called fully complete, the following requirement should be fulfilled:

- All assets should be inserted in schematic diagrams;
- All assets should be connected with pipe lines;
- No pipe lines should have any disconnected ends left. If there is a free end, the end should be supplied with a nozzle or flange;
- All properties of assets and pipe lines should be assigned with values;
- All off-page connectors should be finished and not broken.

Step 4: Setup ShipConstructor Project

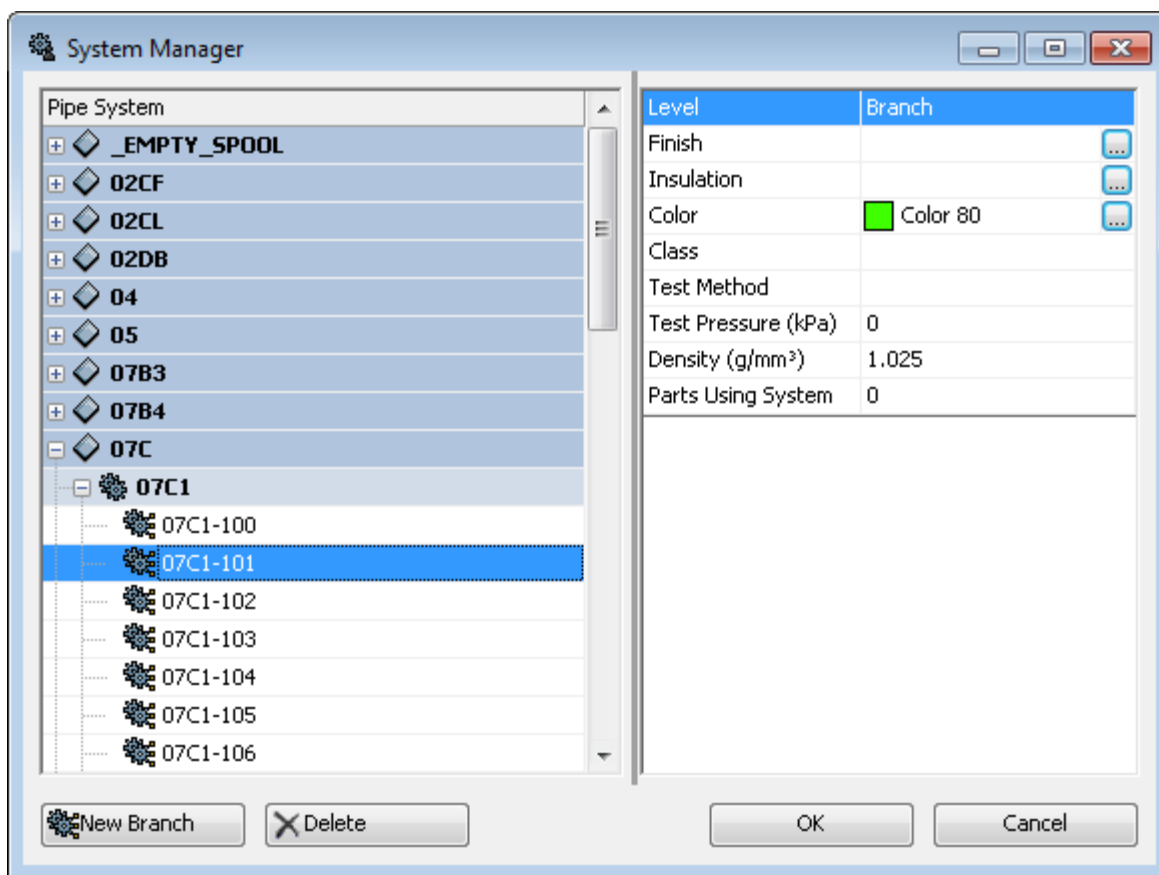
Similar to the P&ID side, the ShipConstructor side should be setup to ensure that the P&ID DesignValidation product can be used efficiently. The following section discusses potential steps that can help bridge ShipConstructor and AutoCAD P&ID.

User-Defined Attributes

Depending on which properties are selected as comparison and identifier properties, the user may need to add a few user-defined attributes to some stock type definitions. For example, if the Tag property is selected as an identifier property for assets on the P&ID side, corresponding equipment on the ShipConstructor side will need an attribute to link to the P&ID tag. The simplest solution is to add a user-defined attribute to all ShipConstructor stock types that represent tagged equipment.

Systems Tree

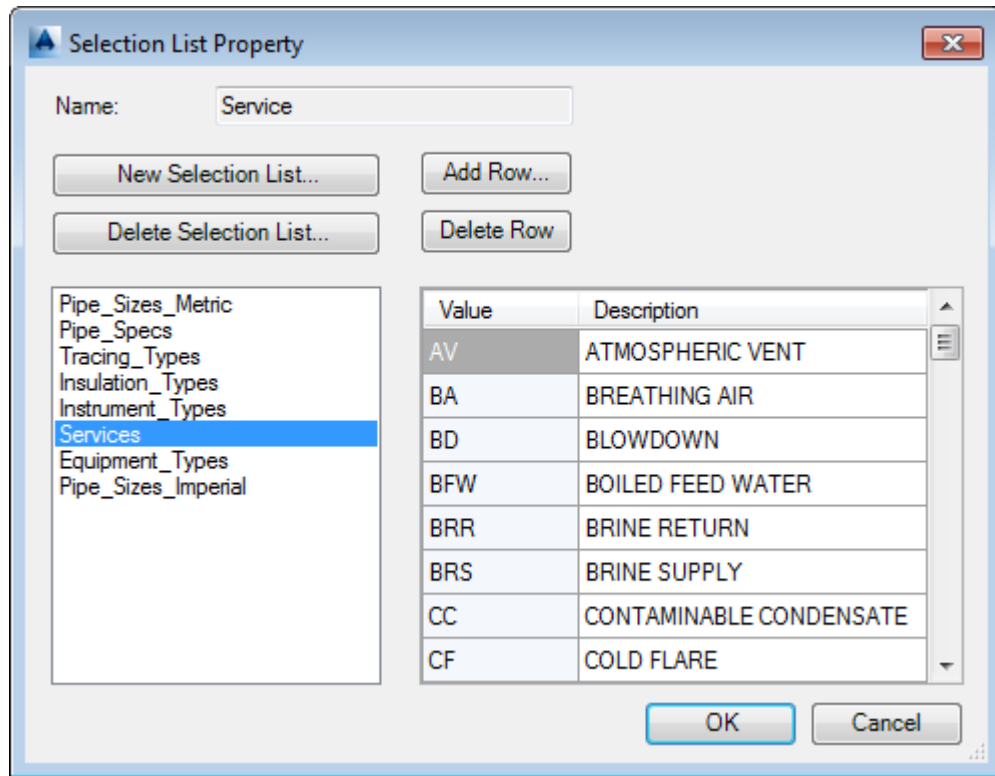
According to the basic P&ID DesignValidation setup discussed previously, the recommended solution is to organize the ShipConstructor Systems tree so that Systems correspond to P&ID Services, Branches correspond to P&ID pipe line groups (Line Number), and Specs correspond to Specs. To ensure comparability, names of ShipConstructor Spec, Systems, and Branches should match precisely with names of P&ID Specs, Services, and Line Numbers.



ShipConstructor Systems Manager

While the basic setup has an apparent benefit of working with group properties that allow assigning identical values to multiple ShipConstructor parts at a time, there are a few constraints of which the user needs to be aware.

The first constraint is that in the ShipConstructor Systems tree, Systems are children of Specs. Such a structure is different from that on the P&ID side. In AutoCAD P&ID, Services and Specs are completely independent of one another. The user can have multiple Specs under the same Service, which is different from the data structure on the ShipConstructor side. To reconcile differences between the two systems, the user may need to duplicate names of some Systems and Branches under different Specs in the ShipConstructor Systems tree.



Editing Values for P&ID Services in AutoCAD P&ID

The second constraint is that often, a ShipConstructor project has to comply with certain requirements regarding the way systems and branches are named in the project. If this is the case, an accommodation needs to be made on the P&ID side. There is plenty of ways a P&ID project can be customized to be comparable against a ShipConstructor project. For example, the user may rely on pipe-line-group tags or pipe-line-segment tags while comparing against a P&ID project. The important thing to keep in mind, however, is that it is much easier to configure a new P&ID project rather than to reconfigure an existing one. As mentioned in Step 1 of the workflow, the user should do some planning in advance to achieve the full leverage on P&ID DesignValidation.

Step 5: Define Mapping Rules

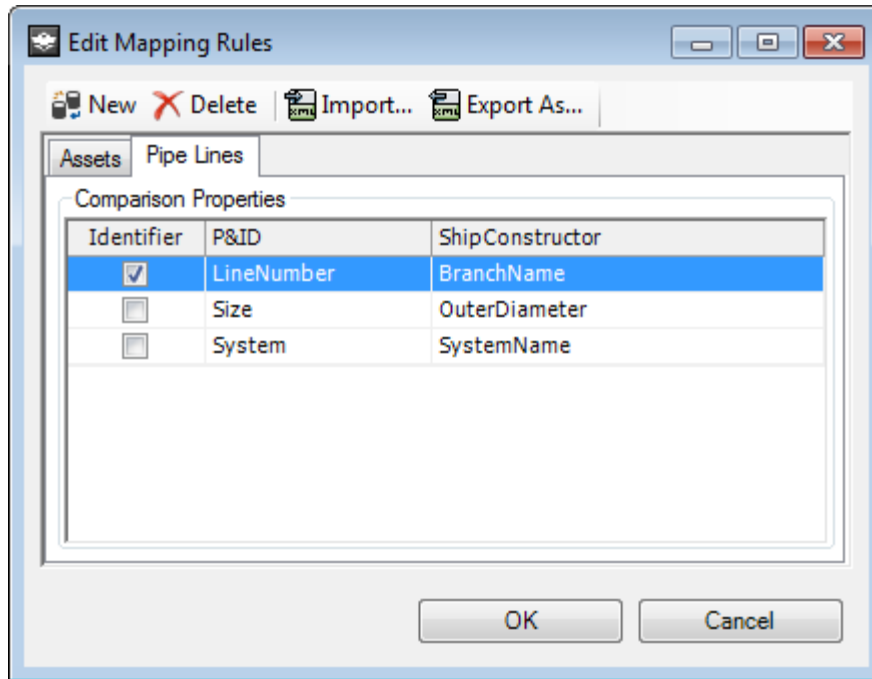
Mapping rules are user-defined relationships between the P&ID and ShipConstructor side. These relationships describe the way object properties on one side of the comparison equation translate into object properties on the other side. Comparing P&ID and ShipConstructor projects is not possible without having mapping rules set up.

P&ID DesignValidation offers two ways for accessing and managing mapping rules: the "Edit Mapping Rules" dialogue (SCPNIDMAPPINGS), and the mapping rules page inside the Setup Wizard dialogue (SCPNIDWIZARD). Both interfaces allow the user to view and edit the same underlying dataset. For example, if the user opens and edits mapping rules via the "Edit Mapping Rules" dialogue, the same rules will be visible in the Wizard dialogues later.

General Process

To map a pair of properties together, the user needs to perform the following steps:

- Open a dialogue form for editing mapping rules (either SCPNIDMAPPINGS or SCPNIDWIZARD);



Edit Mapping Rules Dialogue

- Select either the “Assets” or “Pipe Lines” tab depending on the entity type for which mapping rules need to be setup. Note that Assets and Pipe Lines are two independent sets of mapping rules;
- Add a new rule;
- Type in the name of the property for the P&ID side (see the comment below);
- Type in the name of the property for the ShipConstructor side (see the comment below);
- Put a checkmark in the “Identifier” checkbox if mapped properties should act as identifier properties;
- Click the OK button at the bottom.

Comment: Names of P&ID or ShipConstructor properties that the user specifies while creating mapping rules are not the same names as the ones visible in the AutoCAD “Properties” window (OPM). Mapping Rules consume internal property names as they are stored in the database, which is often different from the OPM name. For example, the Branch property appears as “Branch Name” in the OPM, but its internal database name is “BranchName.”

Identifier and Comparison Properties

Identifier Properties

As it was mentioned earlier in this manual, identifier properties tell what a comparable entity is. Without having any identifier properties, P&ID DesignValidation wouldn’t know how to subdivide source datasets into comparable entities. Correctly defined mapping rules require specification of one or more identifier properties for assets and one or more identifier properties for pipe lines. To introduce an identifier property, the “Identifier” checkbox should be checked.

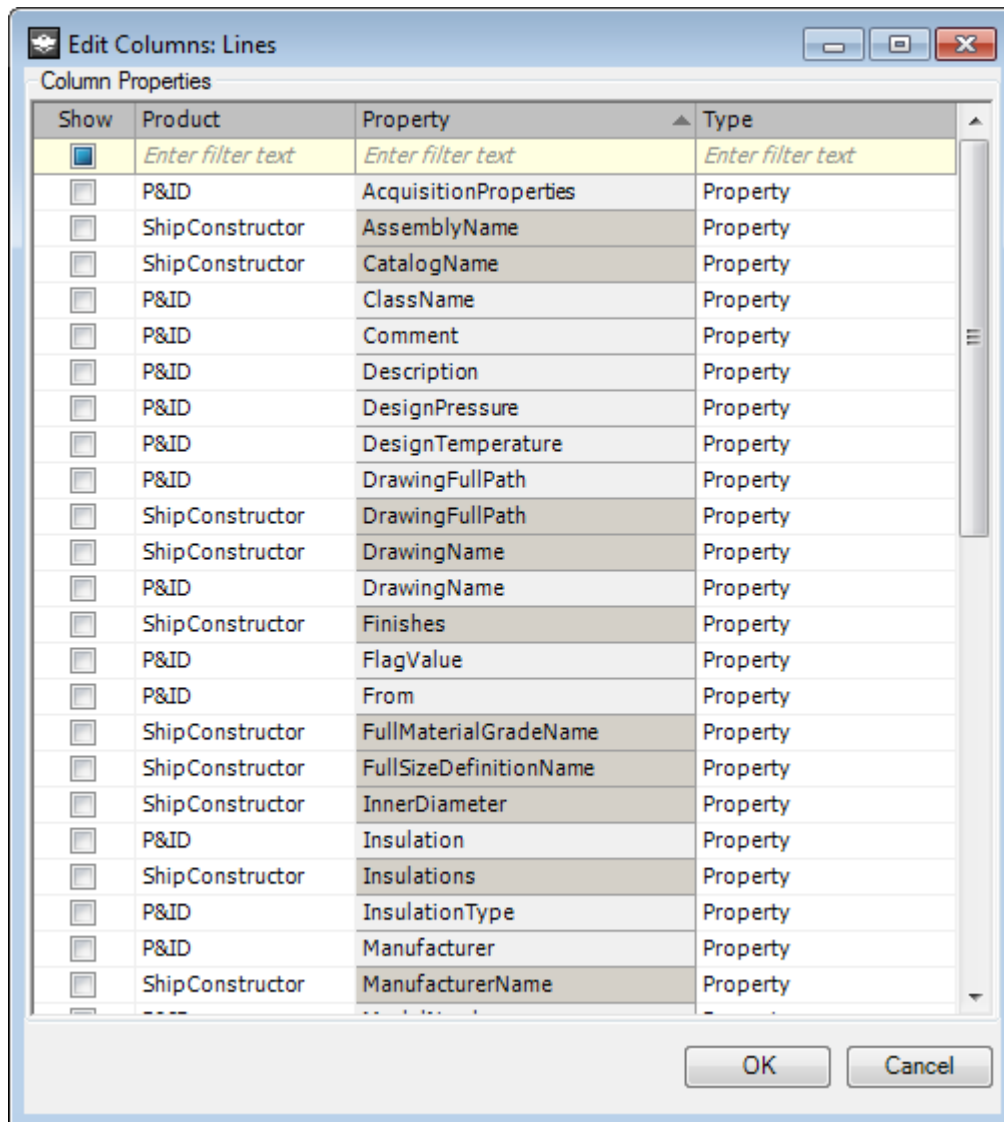
Comparison Properties

Properties that are not checked as “Identifier” are treated as “Comparison” properties. Comparison properties are used to evaluate how closely two or more entities that are deemed to be identical based on their identifier properties match with each other.

Internal Property Names

This release of P&ID DesignValidation does not support a feature that assists users in finding out internal property names as they exist in the database. To find out internal names, the user may need to undertake a few extra steps. The idea behind these steps is to run a trial comparison based on known property names and use temporary results to identify the rest of the names. The steps are described below:

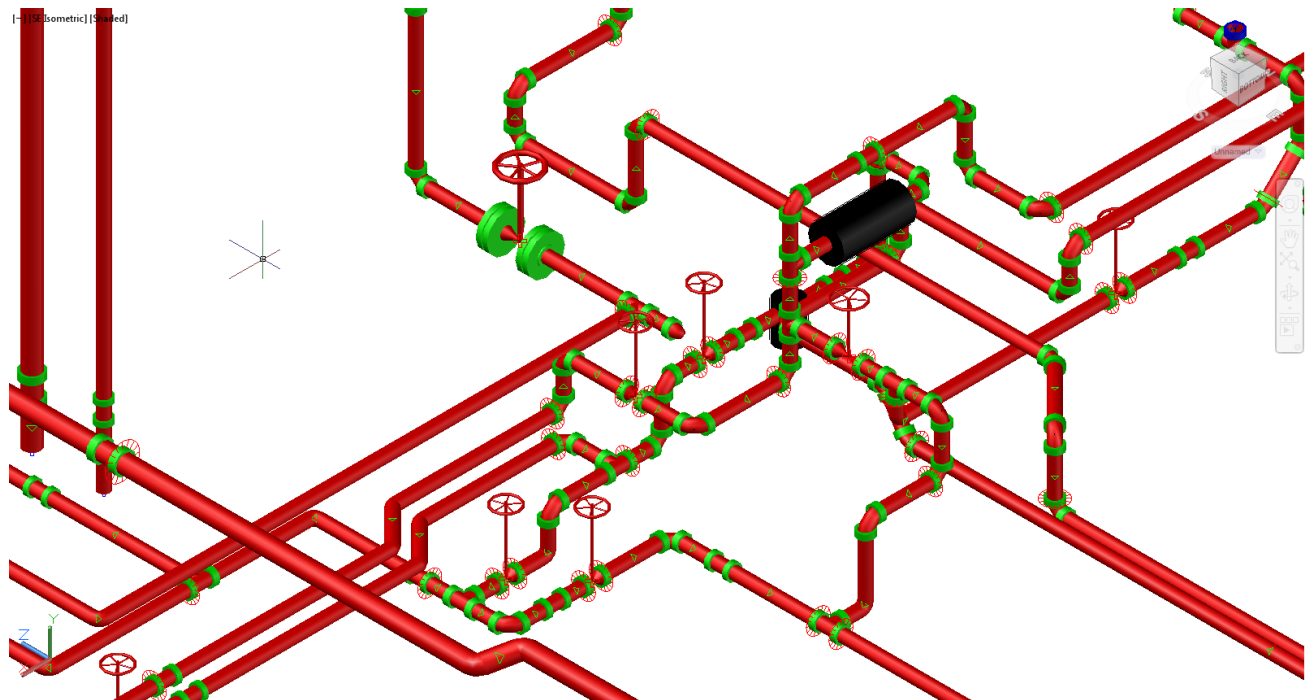
- Connect to a non-blank AutoCAD P&ID project and ensure that a non blank ShipConstructor project with some pipe parts in it is available. For the purpose of the trial comparison, it does not matter which specific projects to use. The projects do not have to actually match. They can be any;
- Start a new comparison operation by opening the Wizard dialogue (SCPNIDWIZARD);
- If the projects are too large to be processed quickly, reduce the comparable scope as necessary by applying P&ID and ShipConstructor filters;
- One the Mapping Rules page:
 - Add one mapping rule under “Assets.” For the P&ID side, specify the name of the property as “Tag.” For the ShipConstructor side, specify the name of the property as “PartName”;
 - Ensure that the “Identifier” checkbox is checked;
 - Add one mapping rule under “Pipe Lines.” For the P&ID side, specify the name of the property as “LineNumber.” For the ShipConstructor side, specify the name of the property as “BranchName”;
 - Ensure that the “Identifier” checkbox is checked;
 - Click “Next”;
- Run a P&ID DesignValidation comparison operation;
- After the comparison process finishes, the “Results Review” dialogue will open automatically;
- In the “Results Review” dialogue, go to the “Assets” tab and right-click a column header;
- From the drop-down menu, choose “Columns”;
- In the “Property” column, see the list of asset-related property names as they appear in the database. Note that some of the property names apply to the P&ID side while others apply to the ShipConstructor side. These names can be used when creating mapping rules for assets.
- A similar list of internal property names related to pipe lines and pipe parts can be viewed by following identical steps while starting from the “Lines” tab in the “Results Review” dialogue.



Internal Property Names Shown in Columns List Dialogue

Step 6: Create 3D Model in ShipConstructor

According to the main usage case for P&ID DesignValidation, modeling in the ShipConstructor project is expected to occur after the P&ID side is partially or fully completed. To ensure compliance with P&ID design, it is beneficial to periodically run the P&ID DesignValidation comparison operation while creating the 3D model in ShipConstructor.



ShipConstructor 3D Model

One way to run the comparison operation is by connecting to the AutoCAD P&ID project directly. The benefits of having the direct access to the P&ID side are: (1) the possibility of staying up-to-date with all of the recent changes that happened on the P&ID side, and (2) the opportunity to make immediate changes on the P&ID side. The main disadvantage is the complexity arising from managing potentially shared access to the P&ID project.

As an alternative way to refer to the P&ID project, running the comparison against an XML output exported from the P&ID side ahead of time can be used. The command that allows exporting P&ID data into an XML file is called "SCPNIEXPORTPNID." When this command is run, it creates an XML snapshot of the current state of the P&ID project that the ShipConstructor side can refer to.

The next section provides more information on exporting data from P&ID and ShipConstructor projects into XML files.

Step 7: Extract Data from P&ID and ShipConstructor Projects

P&ID DesignValidation offers two commands, SCPNIEXPORTPNID and SCPNIEXPORTDS, for exporting data from the P&ID and ShipConstructor sides, respectively, into an XML file. To access the first command (SCPNIEXPORTPNID), the user must launch ShipConstructor in the AutoCAD P&ID environment.

The second command works with all supported AutoCAD platforms. If the user has several AutoCAD platforms installed on his or her computer, the user can specify which AutoCAD platform to associate with ShipConstructor. To do so, the user should run the "Configure ShipConstructor" utility from the Windows "Start" menu and select a platform in the dialogue.

Benefits of XML Export

Data extracted from a project and saved in an XML file automatically becomes a snapshot of that project taken at a particular moment of time. Benefits related to the ability to work with XML snapshots are explained below:

- An XML snapshot can be used to run a comparison operation against it. This feature increases flexibility of the P&ID DesignValidation workflow. For example, the user who works with the ShipConstructor side only does not need to have the P&ID project installed on his or her computer. Instead, he or she may periodically receive XML updates from another user.
- An XML snapshot taken from the P&ID side can be compared against an XML snapshot taken from the ShipConstructor side. This allows users to compare both projects in the “offline” mode. For example, a senior user who checks work after other users may receive periodical updates from all project participants and compare the XML files without the need to connect to each project directly.
- An XML snapshot can be used as a historical document that captures the state of the project at a particular moment of time.

Limitations of XML Export

There are a few things users need to be aware about when using XML export as means of exchanging project information.

- The XML output is dependent on the selection of identifier properties in the mapping rules. The choice of identifier properties affects which objects get exported from the project into the XML file, and how exported objects get classified into assets and pipe line elements. For this reason, if the user redefines identifier properties afterwards, all XML files previously extracted from either P&ID or ShipConstructor side may become invalid from the perspective of new mapping rules. A change to identifier properties should be followed by re-exporting data into XML files.
- When an XML file is used as a source of ShipConstructor information, the validity of the connectivity network cannot be confirmed for pipe systems. The reason is the reliance of the verification mechanism on access to the complete ShipConstructor data model. This model cannot be practically captured in an XML file. The only way to confirm the validity of the connectivity network is to allow P&ID DesignValidation to directly connect to the ShipConstructor database.

Application of Filters

P&ID DesignValidation supports the ability to narrow down the scope of data that gets extracted from the project. To reduce the scope of comparable data, custom filters can be applied on both sides of the comparison equation. The user can manage filters by either doing it from the Setup Wizard dialogue (SCPNIWIZARD) or the from the Edit Filter dialogue (SCPNIWIZARD and SCPNIFILTERDS).

Note that it is only possible to use filters when P&ID DesignValidation is connected to the project directly. Once the data is exported into an XML file, applying the filters to the XML file will not be possible. More information about filters is available in later in this manual.

Step 8: Run P&ID DesignValidation Comparison

Consistency and Connectivity Checks

The comparison feature is the core of the P&ID DesignValidation product. Overall, there are two types of comparison that are currently available as a part of the P&ID DesignValidation workflow: consistency checks and connectivity validation.

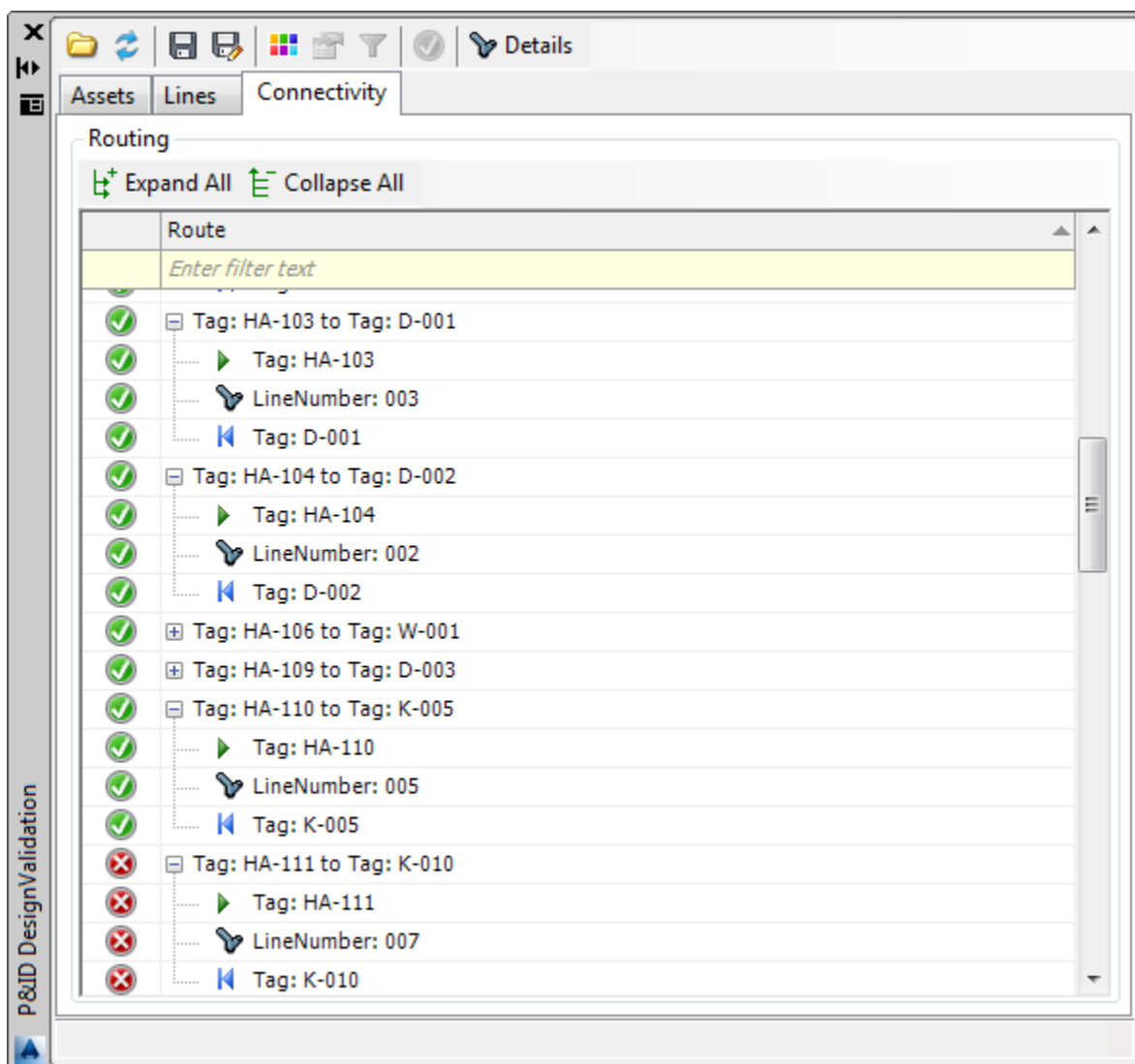
Consistency Checks

Consistency checks allow the user to ensure that each entity on one side of the comparison equation has a matching pair on the opposite side. The consistency checking mechanism confirms not only the fact a match takes place, but also evaluates the quality of each match by looking into comparison properties. Matching pairs that have identical values for all comparison properties are declared to be consistent. Pairs whose comparison properties have different values are declared to be inconsistent.

Connectivity Checks

The connectivity checking mechanism represents the second type of the comparison operation that confirms the validity of the piping network on the P&ID and ShipConstructor side by assessing the similarity of the two networks. The similarity is assessed by breaking the entire P&ID diagram into smaller segments and validating one segment at a time. In P&ID DesignValidation terms, each segment is called the “pipe route.” The general rule for defining P&ID routes is that each route starts with an asset and finishes with an asset while no other asset occurs in the middle of the route. The user may visualize routes as bridges that connect closest assets within the connectivity graph.

From the technical perspective, the initial set of pipe routes is identified based on the P&ID side. Once all the routes are found, routes are compared against the ShipConstructor side. The connectivity checking mechanism relies on identifier properties to validate each individual route on the ShipConstructor side. A pipe route is considered to be verified when a series of corresponding connected pipe parts and fittings leads from the starting asset to the terminus asset of the route in the ShipConstructor 3D model. If the checking mechanism finds an invalid connection, or if the route leads to an unexpected destination, P&ID DesignValidation will report that the route is invalid. The user is able to see all valid and invalid segments of each route on the connectivity tab in the Results Review interface.



Connectivity Information

Setup Wizard

Running a new P&ID DesignValidation comparison can be a multistep process with a number of inputs from the user. The "Setup Wizard" dialogue helps to streamline the process and ensure that the user defines all of the required variables. The specific operations that can be performed on each page are discussed under the "[Setup Wizard for Comparison Operation](#)" (page 32) header in the "[Reference](#)" (page 29) section of this manual. This section only focuses on fundamental questions.

Live Project or XML Snapshot

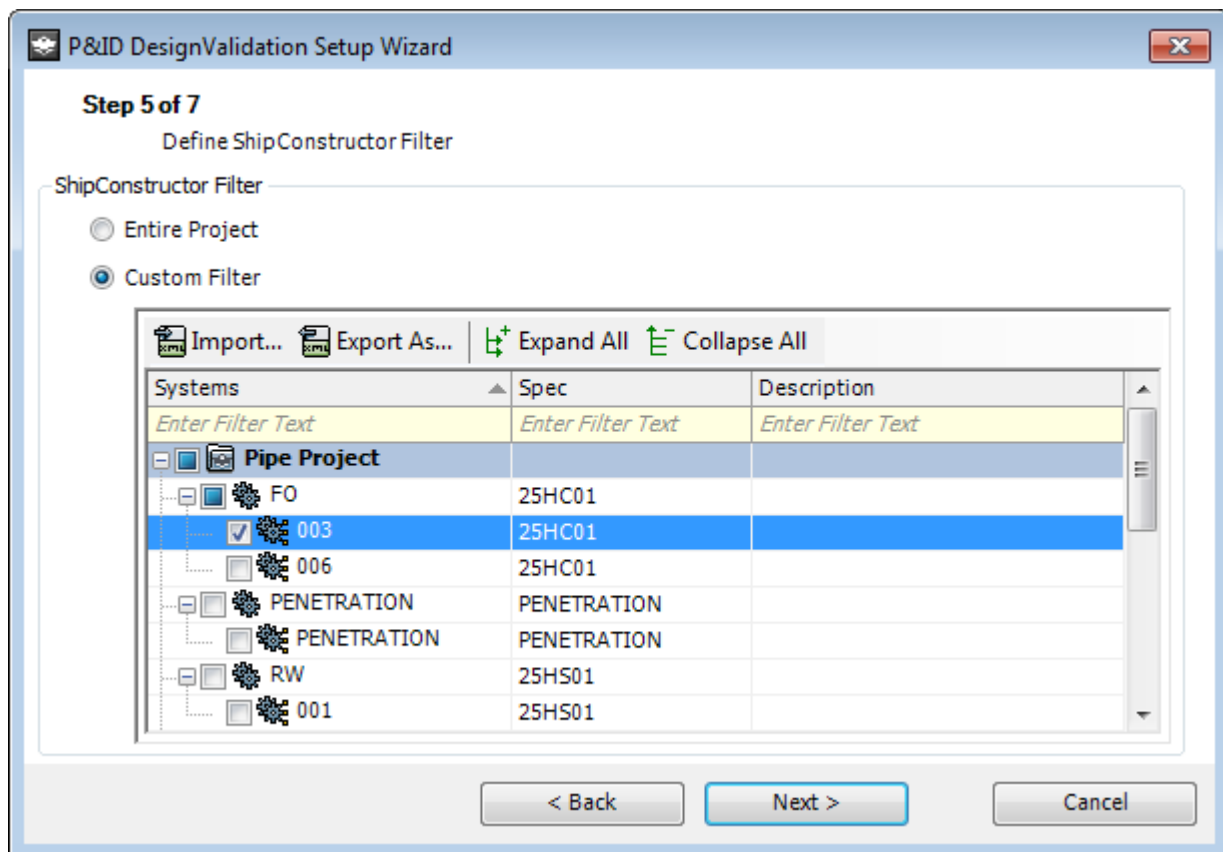
In Step 2a and Step 3a of the Wizard, the user is asked to select the data source for P&ID or ShipConstructor sides. The options available to the user are: the direct connection to a project or an XML snapshot.

There are a few differences between these two options:

- When a project is accessed directly, the comparison operation reads the current state of the project. When an XML file is used as a source of information, the comparison operation reads data from a snapshot taken at a certain point in time.
- P&ID DesignValidation filters are only applicable to projects accessed directly. Applying filters to XML files is not supported.
- When XML files are used as a source of information, the user needs to remember that such files are dependent on the mapping rules. If identifier properties in the mapping rules change, all XML output previously extracted from P&ID and ShipConstructor project need to be updated;
- **Only Affects P&ID Side:** to be able to connect to a P&ID project directly, the user needs to be in the AutoCAD P&ID environment and have the P&ID project selected as the current project. If the user is not in the AutoCAD P&ID environment, the direct connection option will not be available for the P&ID side. The reason is that the extraction mechanism that retrieves data from the P&ID side relies on the P&ID functionality that is only available in the AutoCAD P&ID environment.
- **Only Affects ShipConstructor Side:** when an XML file is selected as a source of ShipConstructor information, confirming the validity of the connectivity network for pipe systems is not possible. The comparison mechanism will only be able to confirm consistency for matching pairs of entities.

Benefits of Filtering Data

If the user connects to a project directly, the user will be given an option to set up filters (Steps 3 and 5).



P&ID DesignValidation Wizard Dialogue: Step 5

On the filter page, the user can select whether to compare the entire project or define a custom filter to narrow down the scope of comparable data. Currently, the only available method for filtering P&ID and ShipConstructor data is filtering by System and Branch.

Overall, there are a few reasons for why the user might want to limit the scope of comparable data:

- If the work on a project is still in progress, some of the project's portions may still be incomplete by the time the comparison takes place. It may make sense to exclude incomplete portions of the project from the comparison range to avoid seeing multiple broken and inconsistent entities.
- The amount of time the comparison operation consumes is proportionate to the size of the dataset on each side of the comparison equation as well as the quality of the network connection between the user's computer and the project server. Sometimes, a comparison operation performed on large projects may take a substantial amount of time to complete. Taking into account that in practice, many users focus on one local area at a time, running a comparison for the entire project may not be necessary. To optimize performance and minimize wait times, the user might want to limit the scope of the comparison operation to only those systems and branches where recent changes took place.

SCPINDCOMPARE

If user wants to repeat the last comparison operation while no P&ID DesignValidation settings have changed, going through the Setup Wizard dialogue can be avoided. The SCPINDCOMPARE command is a one-step operation that repeats the entire comparison process while skipping through all of the steps of the Wizard. To perform the comparison, SCPINDCOMPARE uses current P&ID DesignValidation settings.

A typical scenario where the user might want to quickly repeat the comparison operation without changing its settings is where the user fixes some inconsistencies on either P&ID or ShipConstructor side and decides to refresh comparison results.

Not that there is also a scriptable version of this command: -SCPINDCOMPARE.

Step 9: Access P&ID DesignValidation Commands Directly

In addition to the Wizard dialogue that streamlines the entire comparison process, P&ID DesignValidation offers a set of commands for accessing and modifying P&ID DesignValidation settings via independent dialogues. For example, at any point in time, the user may change project filters or reconfigure mapping rules without starting the Wizard dialogue.

More information on individual P&ID DesignValidation commands is available in the [Reference](#) (page 29) section of this manual.

Step 10: Review Comparison Results

General Organization

P&ID DesignValidation offers a comprehensive interface for reviewing and interpreting comparison results. The interface consists of two dynamically linked AutoCAD palettes that show the Composite View and the Detailed View of comparison results.

Out of the two palettes, the Composite View palette is the main one. What happens in this palette affects the information displayed in the Detailed View palette. In the Detailed View, the data is linked to the current selection in the Composite View palette.

Composite View

Overall, the Composite View palette shows two types of comparison results: consistency checks and connectivity checks. The information is organized into three tabs: “Assets,” “Pipe Lines,” and “Connectivity.” The first two tabs show consistency checking results, and the last tab shows connectivity data.

	P&ID Tag	ShipConstructor pidTag	PartName
Matched	K-002	K-002	Fuel Tank
Matched	P-002	P-002	Gear Pump
Matched	HA-103	HA-103	Ball Valve 50mm-004
Matched	D-002	D-002	Heat Consumer 01
Matched	D-003	D-003	Heat Consumer 02
Matched	HA-104	HA-104	Ball Valve 50mm-002
Matched	HA-106	HA-106	Ball Valve 50mm-001
Matched	HA-109	HA-109	Ball Valve 50mm-003
Matched	W-001	W-001	Cooler
Broken	K-003	K-003	*N/A*
Matched	K-004	K-004	Water Tank
Matched	K-005	K-005	Water Tank
Matched	HA-110	HA-110	Ball Valve 100mm-003

Composite View Palette

Assets and Lines Tabs

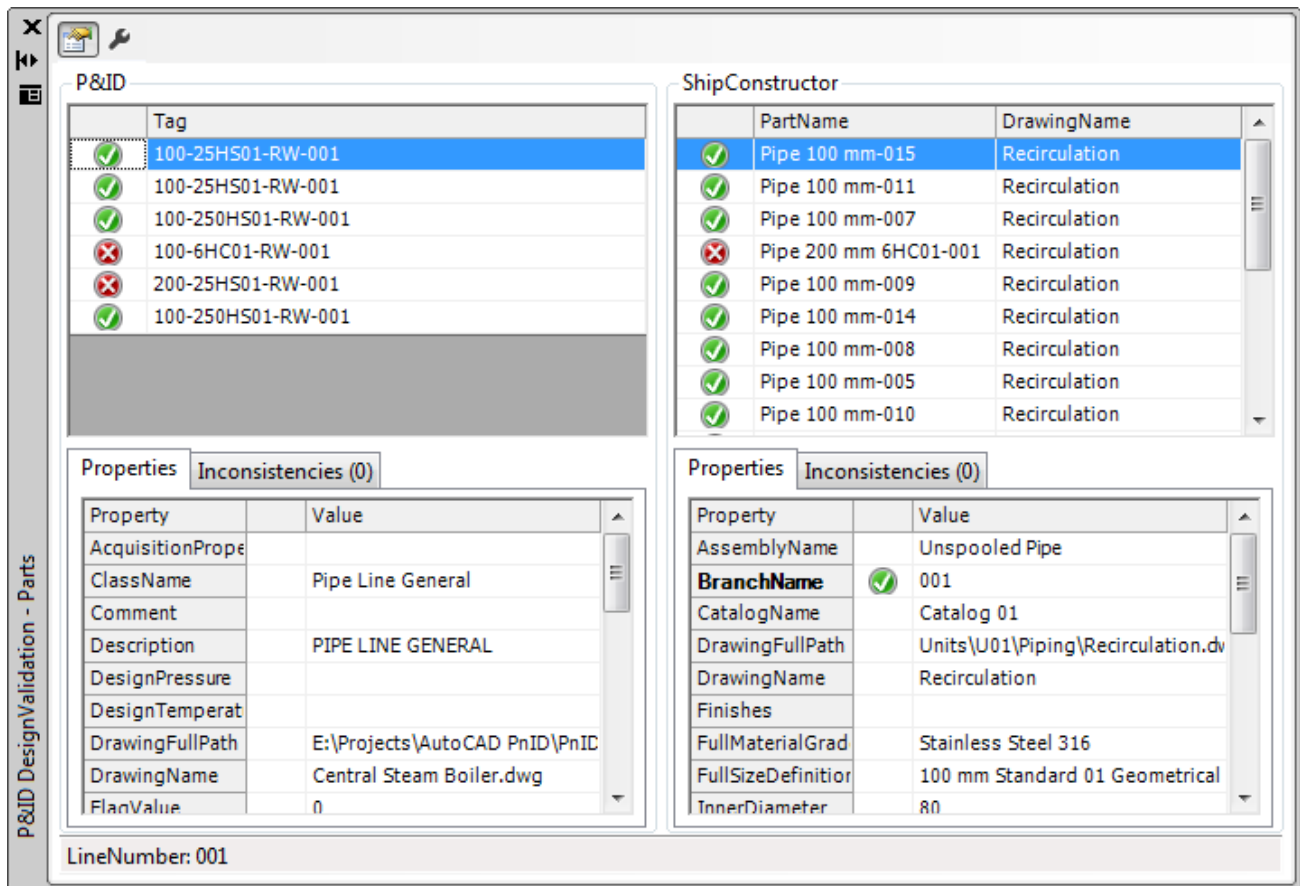
On the “Assets” and “Lines” tabs, entities are recognized by their identifier properties and presented as matching pairs. The state of each matching pair is explained in the Status column. In general, the following statuses may be reported in the Composite View: Matched, Broken, Inconsistent, Unresolved, and Resolved. More information on statuses is available later in this manual.

Connectivity Tab

On the “Connectivity” tab, the user can see pipe routes and their states reported by P&ID DesignValidation. The routes are organized into groups of related elements. Each route starts with an asset and finishes with an asset. In the middle of the route, only pipe line segments can present. For each successfully validated element of a pipe route, the green icon appears next to the name of that element. For all elements that failed validation, the red icon appears next to the name of the element.

Detailed View

The Detailed View palette is an expanded look inside a specific pair of matching entities selected in the Composite View palette. In the Detailed View, the user can see all the individual parts that appear inside the matching entity.



Detailed View Palette

For example, consider a scenario where a P&ID pipe line matches with a group of ShipConstructor pipe parts. In this scenario, the Composite View palette will only show an aggregate record that speaks of the entire pipe line, but not its underlying pipe parts. However, if the user opens the Detailed View palette, the user will see all of the individual components that constitute the entity on each side of the comparison equation.

Step 11: Investigate Individual Cases

Overall, there are two broad types of cases that may require an investigation: consistency errors and connectivity errors. Consistency errors occur when P&ID DesignValidation fails to identify an ideally matching pair of assets or pipe line entities while looking at both sides of the comparison equation. Connectivity mistakes occur due to broken connections or unexpected objects encountered along pipe routes.

A generally recommended workflow for investigating errors is to start with consistency errors and then, proceed to connectivity errors. The reason is that consistency errors are often the source of connectivity mistakes. By addressing all of the inconsistencies in the project, the user may be able to resolve a significant portion of connectivity errors.

Consistency Errors

The recommended process for investigating consistency errors is to run the comparison, assess the overall situation based on the information displayed on "Assets" and "Lines" tabs in the Composite View palette, and proceed to the

detailed investigation of each case by opening the Detailed View palette and taking a closer look into underlying entities. The next few paragraphs discuss various types of errors reported by P&ID DesignValidation.

Broken Pairs

Technically, a broken pair of matching entities is not a pair at all. It is a single entity that has failed to find its match on the opposite side of the comparison equation. In the Composite View, the user can recognize broken pairs by looking at two factors: the “Broken” state displayed in the Status column and custom colors.

If the user opens the Detailed View for a broken pair, the user will see that one side of the palette shows blank data. The blank side will be the one where P&ID DesignValidation was unable to find the corresponding entity.

Likely causes for broken pairs are outlined below:

- Mistakes in Mapping Rules – a misspelled mapping rule may have a significant impact on validity of comparison results. Usually, this type of error leads to multiple broken pairs reported by P&ID DesignValidation.
- Disproportionate Filters – if the user sets up different filters on opposite sides of the comparison equation, the extracted dataset may be inherently unequal between the two sides. This may lead to a situation where a number of entities presents on one side and absents on the other.
- Missing Objects – a comparable object can in fact be missing from one of the sides of the comparison equation for various reasons.
- Incorrectly Filled Values of Identifier Properties – if the user puts an incorrect value into an identifier property, the object may not be recognizable by the other side of the comparison equation. In a sense, values of identifier properties are keys to the opposite side. If the key is broken, it won't work.

Unresolved Pairs

In P&ID DesignValidation, the “Unresolved” state can only occur for assets. The reason is that assets are expected to be singular and unique entities. When identifier properties that are assigned to different assets on the same side of the comparison equation are given identical values, the uniqueness condition is violated causing an irresolvable state. P&ID DesignValidation does not know which asset to choose to establish a match with the opposite side of the comparison equation.

Note that the “Unresolved” state does not apply to pipe lines because pipe lines are complex objects with multiple underlying subcomponents. For pipe lines, it is normal to have more than one underlying subcomponents that all share the same identifier properties.

The most likely cause for the “Unresolved” state is an incorrect assignment of the same identifier property value to two or more assets on the same side of the comparison equation. The “Unresolved” state is more likely to occur in a scenario where values of identifier properties are entered manually. For example, manually entered tags would be more prone to this type of error.

Inconsistent Pairs

An inconsistently matching pair may occur either with assets or pipe lines. The “Inconsistent” state indicates that despite the fact that all of the identifier properties have matched, one or more comparison properties have not matched. For example, a pair of assets, each coming from the opposite side of the comparison equation, can match based on their tag values; however, any difference in their manufacturer names may prompt an inconsistency provided that the Manufacturer Name is a comparison property.

The most common cause for the “Inconsistent” state is incorrectly filled values of comparison properties. Usually, inconsistencies are more likely to happen in a scenario where the user fills in property values manually. P&ID DesignValidation only allows for minor differences in spelling. For example, the presence of leading or terminus space

characters in property values, or differences in letter capitalization are ignored by the comparison mechanism. However, a single misspelled character will become a source of inconsistency.

Step 12: Fix Discrepancies

The final step in the P&ID DesignValidation workflow is fixing discrepancies between the P&ID and ShipConstructor side. The recommended workflow for fixing discrepancies is doing it in an iterative process:

- Run a comparison operation to identify initial discrepancies between the P&ID and ShipConstructor side;
- Evaluate the overall situation by reading information from the Composite View palette;
- Investigate each case individually by referring to the Detailed View palette;
- Whenever necessary, use functionality available in the Detailed View palette to navigate to parts located in model drawings and change parts' properties;
- Occasionally, repeat the comparison operation to see if changes made actually resolved the inconsistencies;
- Repeat above the steps until the last discrepancy is addressed.

Reference

Commands

SCPNIEXPORTDS

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPnIExportDS
Permissions ...	n/a

The SCPNIEXPORTDS command exports equipment and pipe parts from the current ShipConstructor project into an XML file. Later, P&ID DesignValidation can refer to the XML file as a source of information when performing the comparison operation.

SCPNIEXPORTPNID

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPnIExportPnID
Permissions ..	n/a

The SCPNIDEXPORTPNID command exports assets and pipe lines from the current P&ID project into an XML file. Later, P&ID DesignValidation can refer to the XML file as a source of information when performing the comparison operation.

SCPNIDFILTERDS

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDFilterDS
Permissions ..	n/a

The SCPNIDFILTERDS command opens a dialogue for setting up comparison filters for the ShipConstructor side.

SCPNIDFILTERPNID

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDFilterPnID
Permissions ..	n/a

The SCPNIDFILTERPNID command opens a dialogue for setting up comparison filters for the P&ID side.

SCPNIDMAPPINGS

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDMappings
Permissions ..	n/a

The SCPNIDMAPPINGS command opens a dialogue for managing mapping rules. Mapping rules are important settings that define the relationship between P&ID and ShipConstructor side. Without having mapping rules set up, P&ID DesignValidation is unable to perform the comparison operation.

SCPNIDREVIEWRESULTS

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDReviewResults
Permissions ..	n/a

The SCPNIDREVIEWRESULTS command opens the interface for reviewing comparison results, identifying inconsistencies, and navigating to parts in model drawing. Note that the results review interface consists of two

dynamically linked AutoCAD palettes: the Composite View and the Detailed View. By default, the SCPNIDREVIEWRESULTS command opens the Composite View palette only.

SCPNIDCOMPARE

Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDCompare
Permissions ..	n/a

The SCPNIDCOMPARE command repeats the entire comparison operation in a single step. This is an alternative way for comparing projects without going through every page of the Setup Wizard dialogue. As inputs, the SCPNIDCOMPARE command uses the current settings for Mapping Rules and Filters, and values last-specified during a Wizard comparison for P&ID and ShipConstructor sources.

SCPNIDWIZARD

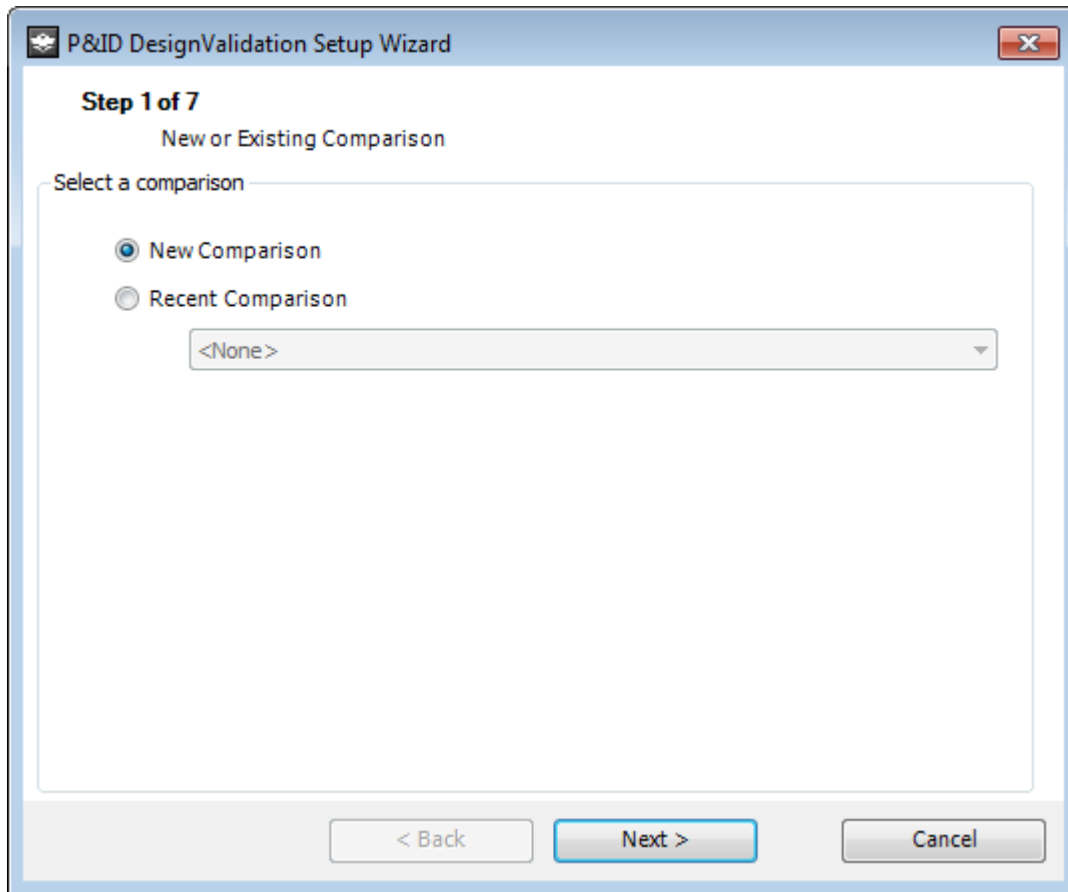
Ribbon	Pipe > P&ID DesignValidation
Menu	ShipConstructor > P&ID DesignValidation
Toolbar	ShipConstructor > PID
Command	SCPNIDWizard
Permissions ..	n/a

The SCPNIDWIZARD command launches the Wizard dialogue that guides the user through the step-by-step comparison process for the P&ID and ShipConstructor projects. In the Wizard dialogue, the user can review and modify all inputs affecting comparison results.

Dialogue Forms

Setup Wizard for Comparison Operation

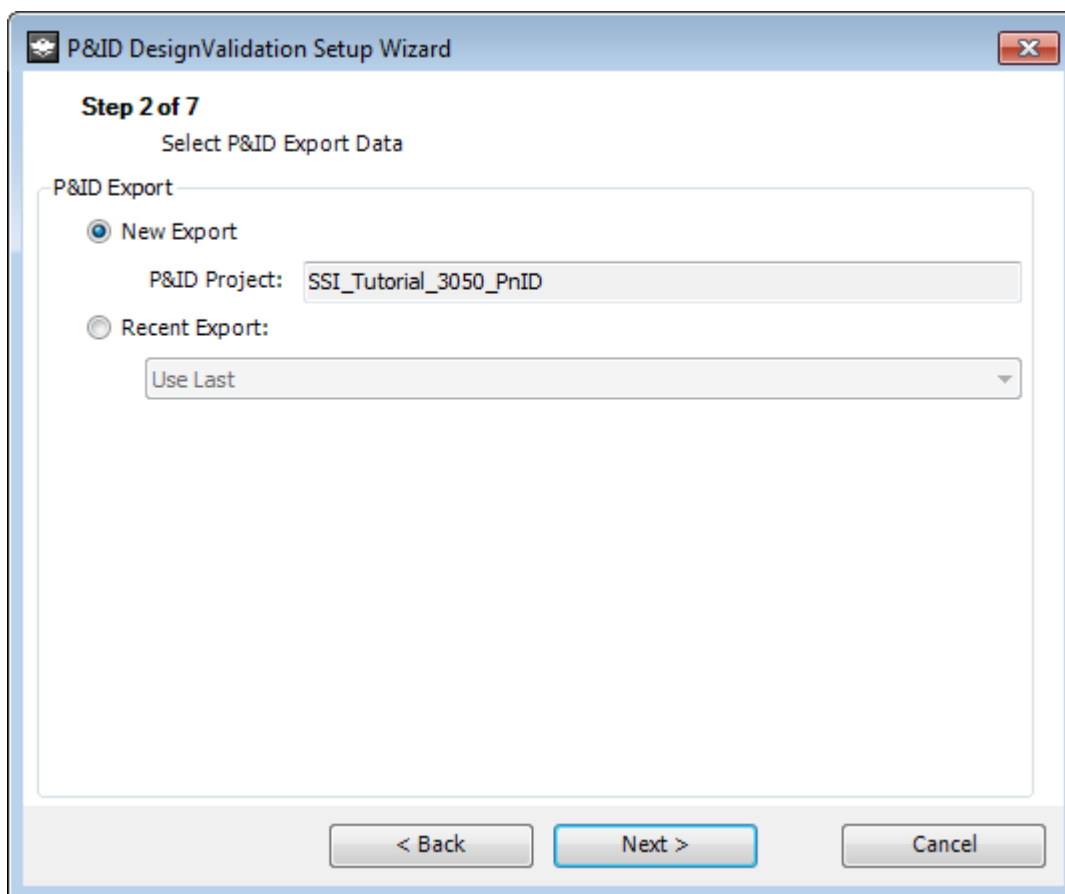
The Wizard dialogue guides the user through the step-by-step comparison process for the P&ID and ShipConstructor projects. In the dialogue, the user can review and modify all inputs affecting the comparison operation. To launch the dialogue, the user should type in the SCPNIDWIZARD command.



Wizard Dialogue: Step 1

On the first page of the Wizard, the user chooses whether to start a new comparison, or to open already generated comparison results. If the user decides to begin a new comparison, clicking the Next button will continue the process.

If the user decides to open existing comparison results, clicking the Next button will transfer the user to the “Open File” dialogue where the user will need to navigate to an XML file with comparison results. Selecting the XML file will close the Wizard dialogue, skip the entire comparison operation, and load the selected file inside the Results Review interface.

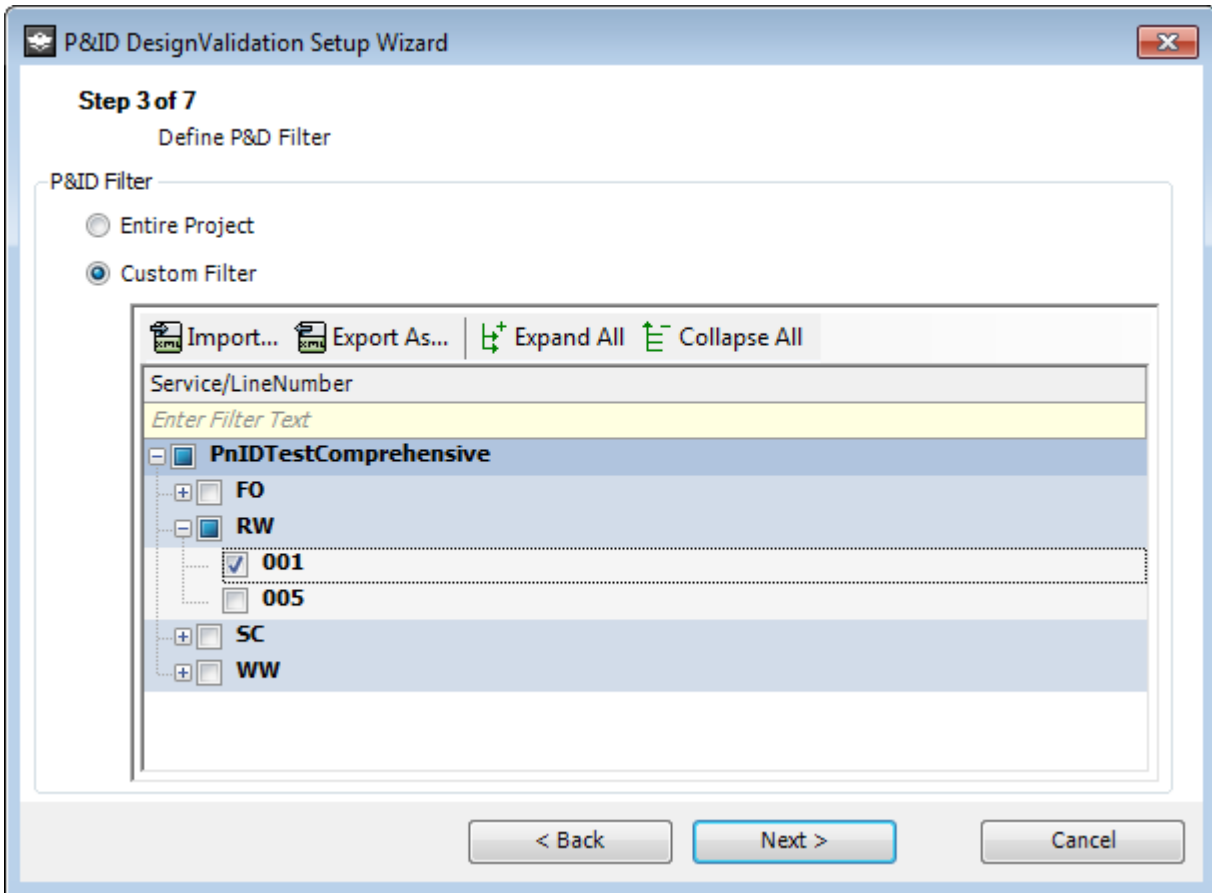


Wizard Dialogue: Step 2

In Step 2, the user chooses the source for the P&ID project. The available options are: a new export from the currently opened project, or an XML snapshot.

If the user wants to extract information directly from a P&ID project, the user should run P&ID DesignValidation in the AutoCAD P&ID environment. If the user selects an XML snapshot as a source of information, running P&ID DesignValidation in the AutoCAD P&ID environment will not be required.

In Step 3, the user specifies which data filters to use while exporting comparable data from the P&ID side. Note that the Wizard dialogue will only take the user to the Step 3 page if the source of P&ID information is a P&ID project. If the source of P&ID information is an XML file, the filter step will be skipped.



Wizard Dialogue: Step 3

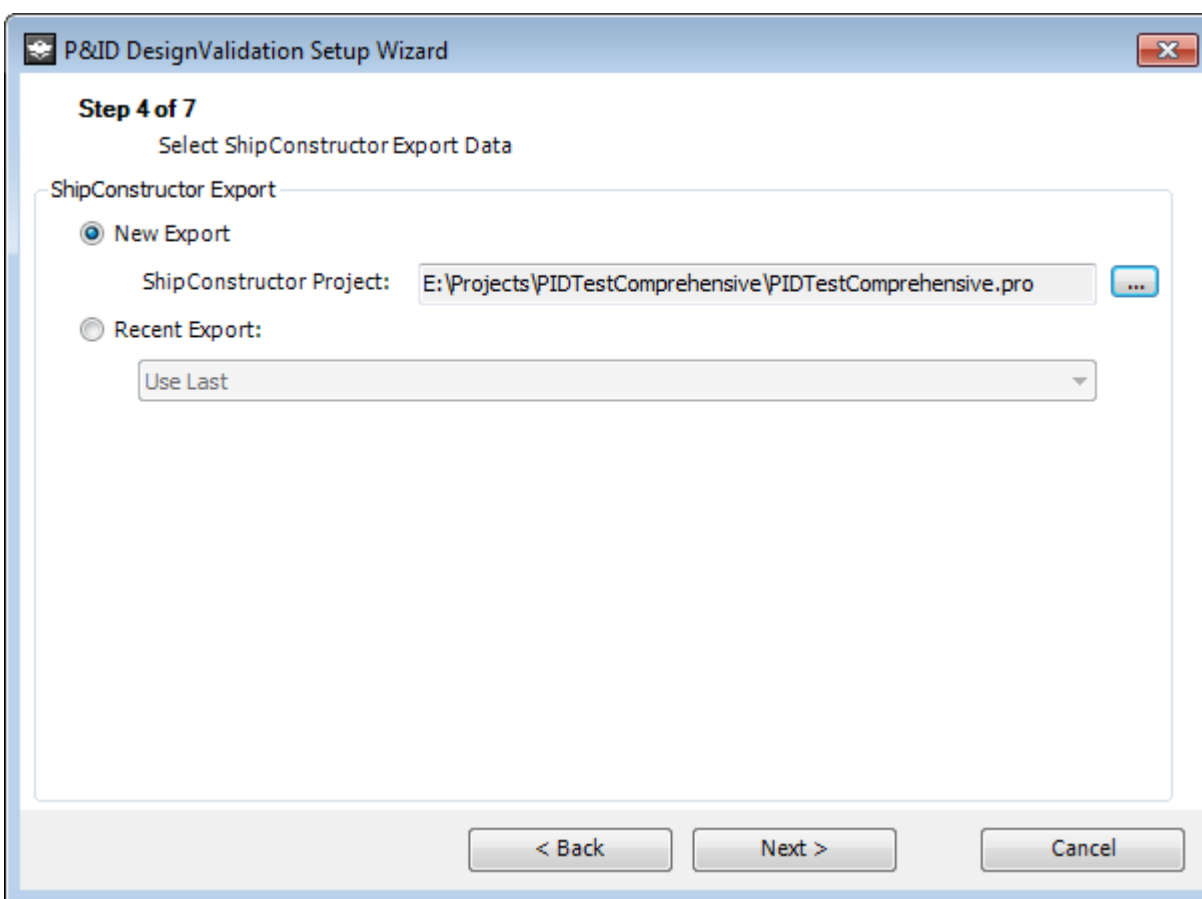
On the filter page, the user can check and uncheck nodes in the “Service/Line Number” tree while narrowing down the scope of comparable data.

The filter selection tree is supplied with four buttons at the top. The “Import” and “Export As...” buttons allow the user to load a previously-saved filter selection from an XML file as well as to save the current filter selection into an XML file. The Import / Export functionality may be used to store different presets and exchange filter information among several project participants. The “Expand All” and “Collapse All” are standard controls for managing the tree behavior.

Finally, the selection tree has the string filter row at the top. The user can type in values into the string filter row to quickly find required elements in the tree below.

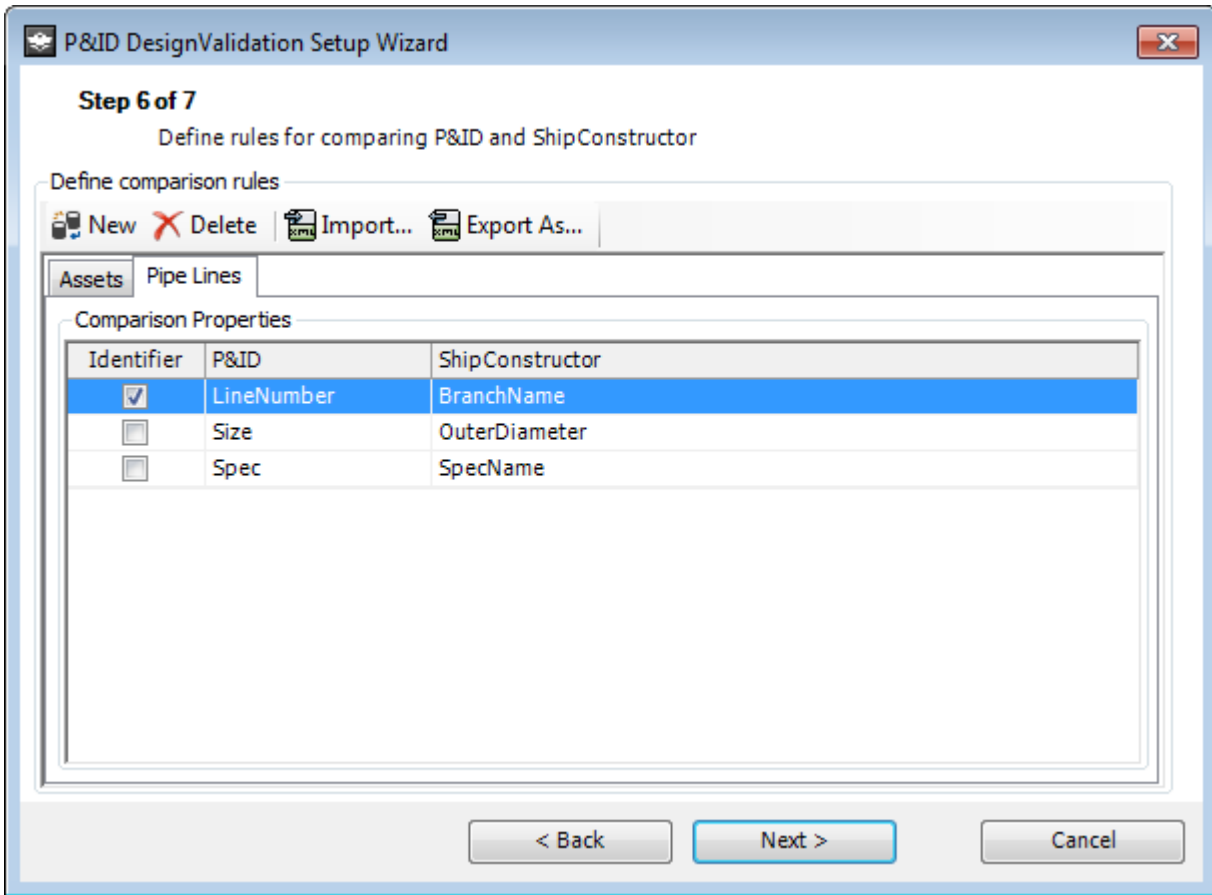
Steps 4 and 5 are identical to Steps 2 and Step 3. The only difference is that these steps apply to the ShipConstructor side of the comparison equation.

For the ShipConstructor side, the user can choose which project to use as a source of information when performing P&ID DesignValidation comparison. If clicks the browse button located next to the project path field, P&ID DesignValidation will ask to navigate to a *.pro of a ShipConstructor project.



Wizard Dialogue: Step 4

In Step 6, the user specifies Mapping Rules for performing the comparison operation.

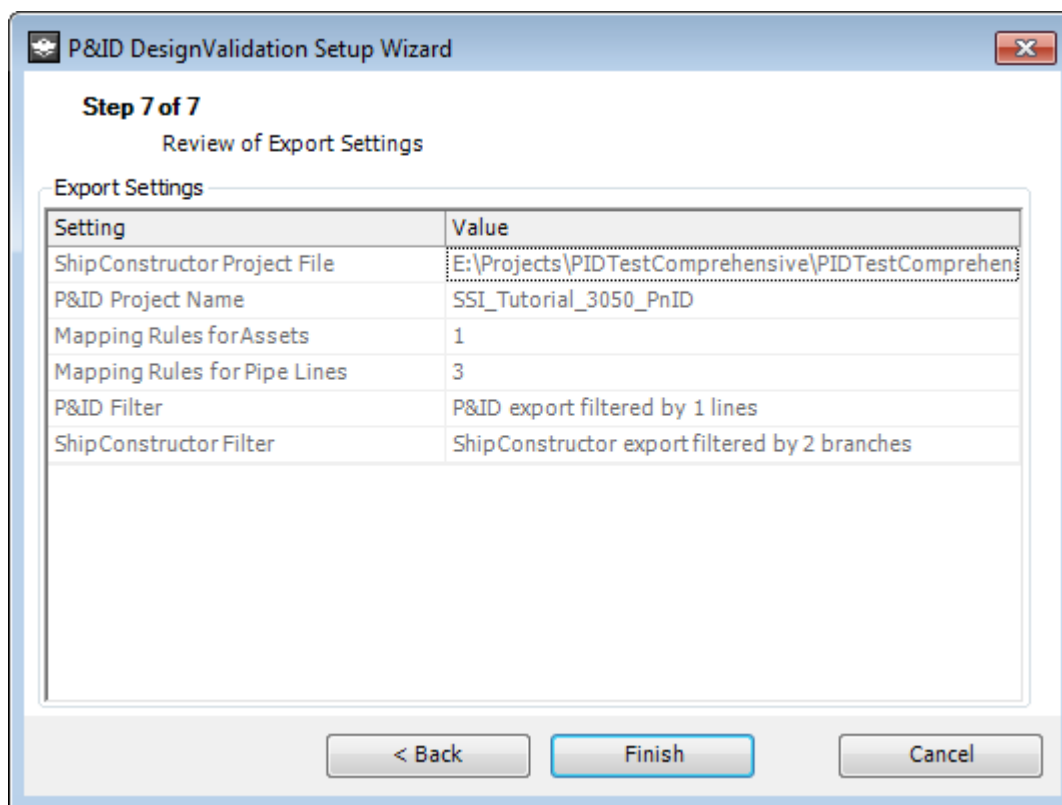


Wizard Dialogue: Step 6

The user can add and remove mapping rules as well as specify identifier properties. The user can also import and export mapping rules definitions via the XML interface.

Note that when typing names of P&ID and ShipConstructor properties involved in mapping rules, the user should refer to internal property names as defined in P&ID and ShipConstructor database. More information on internal property names is available in the [“Internal Property Names”](#) (page 18) section under the [“Step 5: Define Mapping Rules”](#) (page 16) header in the general [Workflow](#) (page 6) description.

The final step of the Wizard dialogue presents the user with an overview of all settings affecting the comparison operation. If the user presses the “Finish” button, the comparison process will begin. If the user cancels out of the Wizard dialogue, any changes made to filters or mapping rules in previous steps will be discarded.



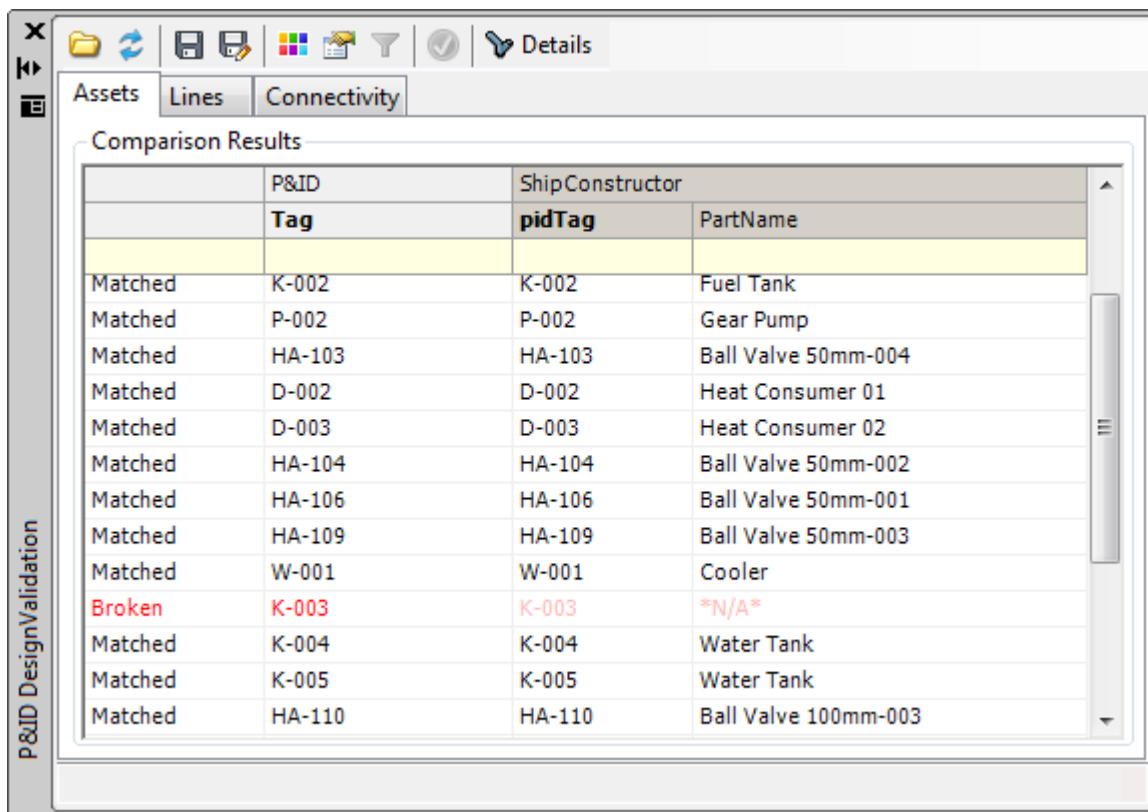
Wizard Dialogue: Final Step

Results Review Interface

Composite and Detailed View Palettes

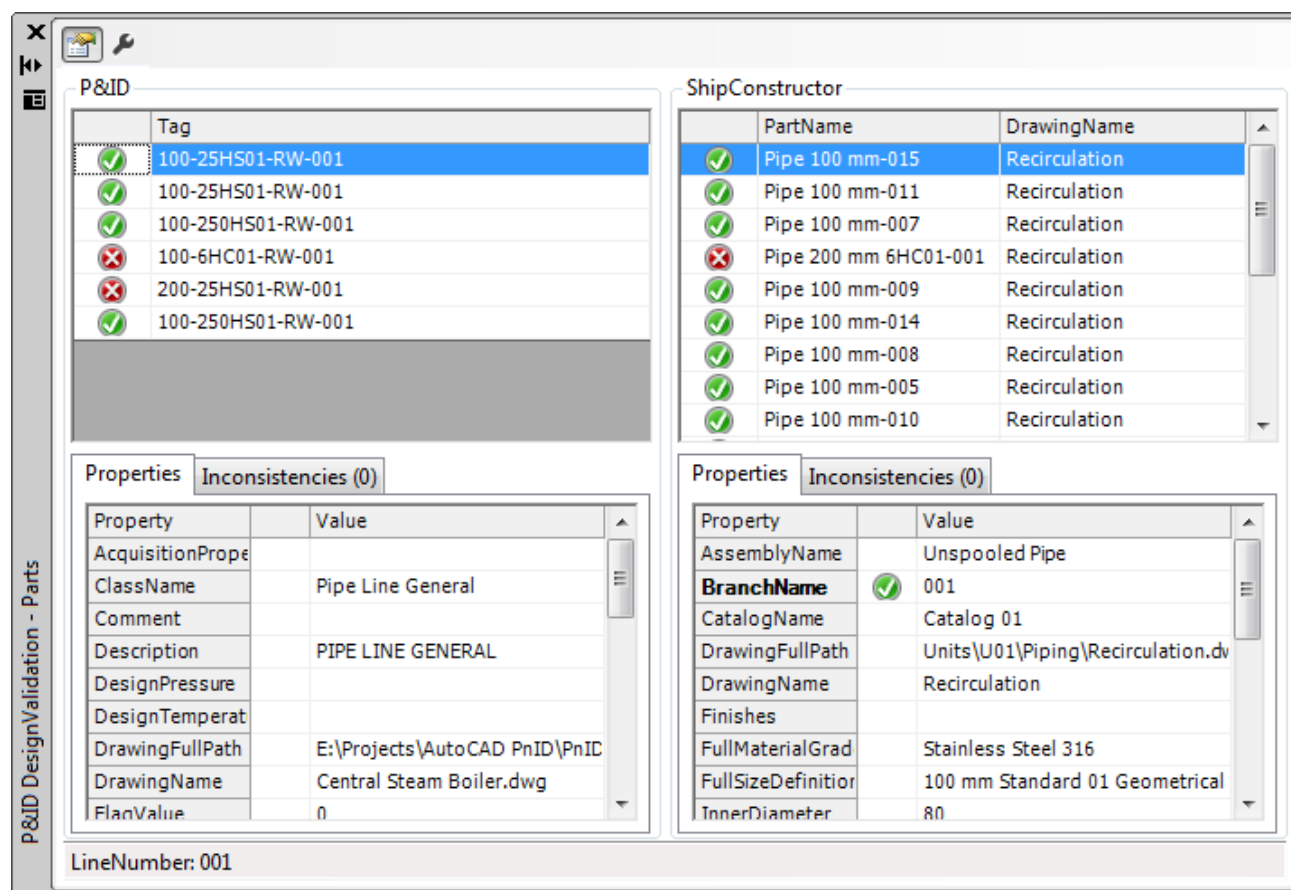
The Results Review interface is used to present comparison results in an easy-to-read format. The interface consists of two dynamically linked palettes: the Composite View palette and the Detailed View palette. Between the two palettes, the Composite View palette is the main one. If the user changes the current selection in the Composite View palette, the action will affect information displayed in the Detailed View palette.

The Composite View palette can be opened with the SCPNIDRESULTSREVIEW command at any time. In addition to this, the palette opens automatically every time the SCPNIDCOMPARE or SCPNIDWIZARD command finishes its work.



Composite View

The Composite View palette shows entities identified based on unique values assigned to identifier properties of P&ID and ShipConstructor objects. The entities are presented as matching pairs; however, some matching pairs may be displayed as “Broken.” More information on different states of entities in the Composite View palette is available in the [“Step 11: Investigate Individual Cases”](#) (page 27) section of this manual.












Detailed View

The Detailed View palette does not open automatically. To open this palette, the user needs to click the “Details” button in the Composite View palette. The Detailed View palette shows individual ShipConstructor and P&ID objects that stand behind the matched pair of entities that are currently selected in the Composite View palette. In the Detailed View palette, the number of individual objects on the P&ID and ShipConstructor side is frequently different.

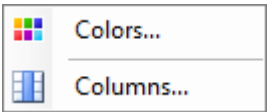
Controls in Composite View Palette

The Composite View palette has the following controls:

Button	Function
 Load	Loads comparison results from an XML file into the Results Review interface. The XML file should be previously saved by the user on the computer hard drive.
 Refresh	Reloads the current XML file into the Results Review interface. The operation may be necessary in a situation where the current XML file changes outside of the regular P&ID DesignValidation comparison workflow. As a another usage case, the Refresh button can be used to reverse comparison results to their original state after a number of matching pairs are marked as resolved.
 Save	Saves comparison results into an XML file.

 Save As	Saves comparison results into an XML file with a new name.
 Colors	Opens the “Colors” dialogue where the user can setup custom foreground and background colors for different comparison states such as Matched, Broken, Inconsistent, and Unresolved. Custom colors can be used as an efficient visual instrument for quickly recognizing important information.
 Properties	Shows and hides the Properties area on the right hand side of the dialogue. The Properties area displays aggregate properties for the currently selected matching pair of entities in the Composite View palette. The list of properties is similar to that that the user can find in the AutoCAD OPM.
 Filters	Opens the dialogue that shows filters that were applied to the P&ID and ShipConstructor side while running the P&ID DesignValidation comparison operation.
 Resolved	<p>Marks the currently selected entity as “Resolved.” The button can be helpful in a situation where the user wants to keep track of resolved cases while avoiding an immediate regeneration of comparison results.</p> <p>Note that there is no relationship between marking an item as resolved and actually resolving the problem. The “Resolved” button simply acts like a marker with no sophisticated logic attached to it.</p>
 Details	Opens the Detailed View palette. The Detailed View palette allows the user to look inside the pair of matching entities currently selected in the Composite View palette.

In addition to buttons located at the top of the Composite View palette, the user has access to the context menu inside the table that shows matching entities. If the user does the right-click on a column header, the following menu will appear:




Header Row Context Menu

If the user clicks “Columns” in the context menu, the “Edit Columns” dialogue will open. In the “Edit Columns” dialogue, the user can specify which columns should be visible in the table view. Once all visible columns are checked, the user can arrange columns in a custom order by dragging the columns by the header cell with the mouse.

Controls in Detailed View Palette

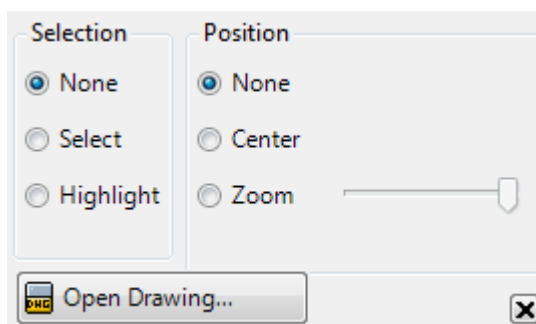
The Detailed View palette has the following controls:

Button	Function
 Properties	Shows and hides the Properties area in the bottom half of the dialogue. The list of properties displayed at the bottom of the dialogue is similar to the list that the user can find in the AutoCAD OPM.

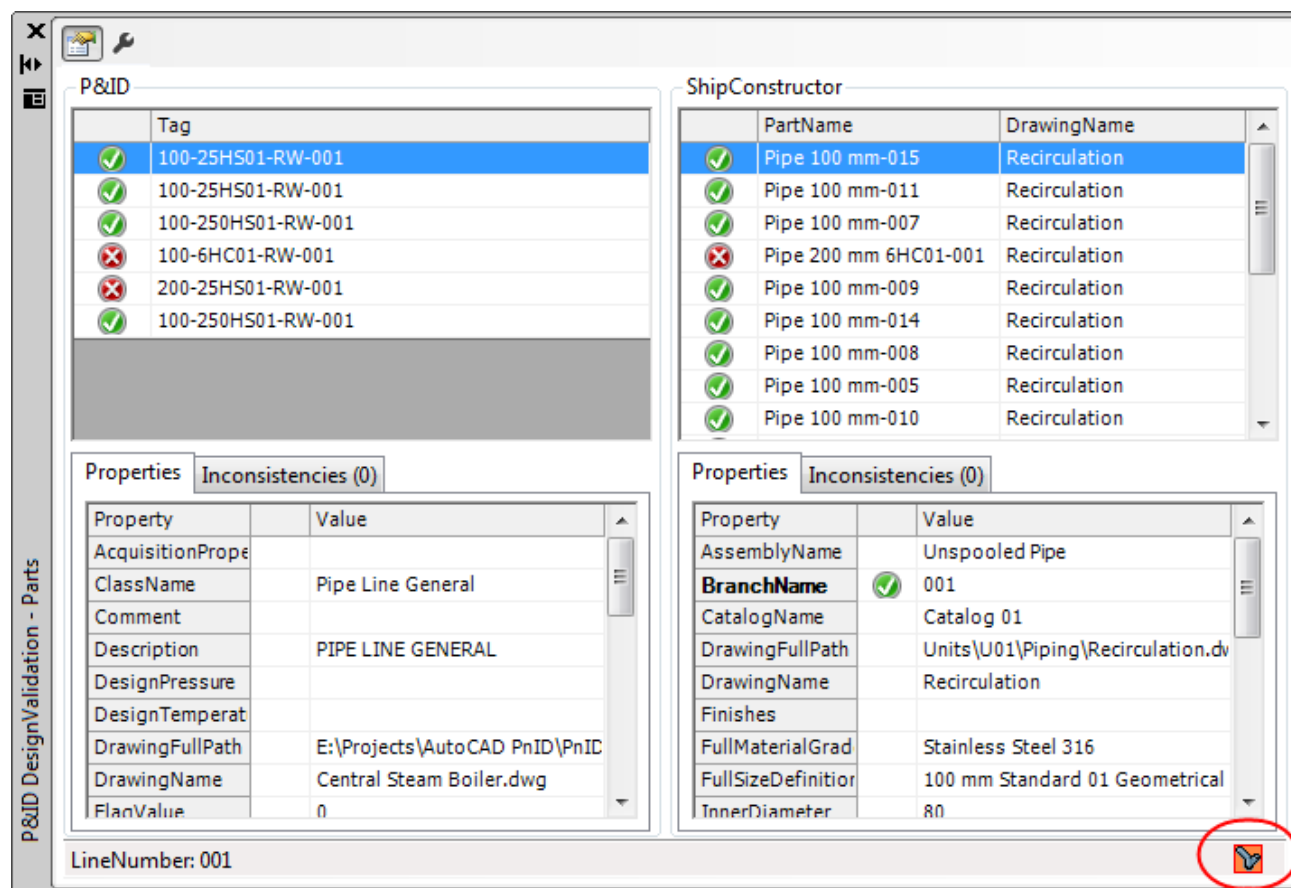


Tools

The tools button brings up the “Drawing Tools” palette:



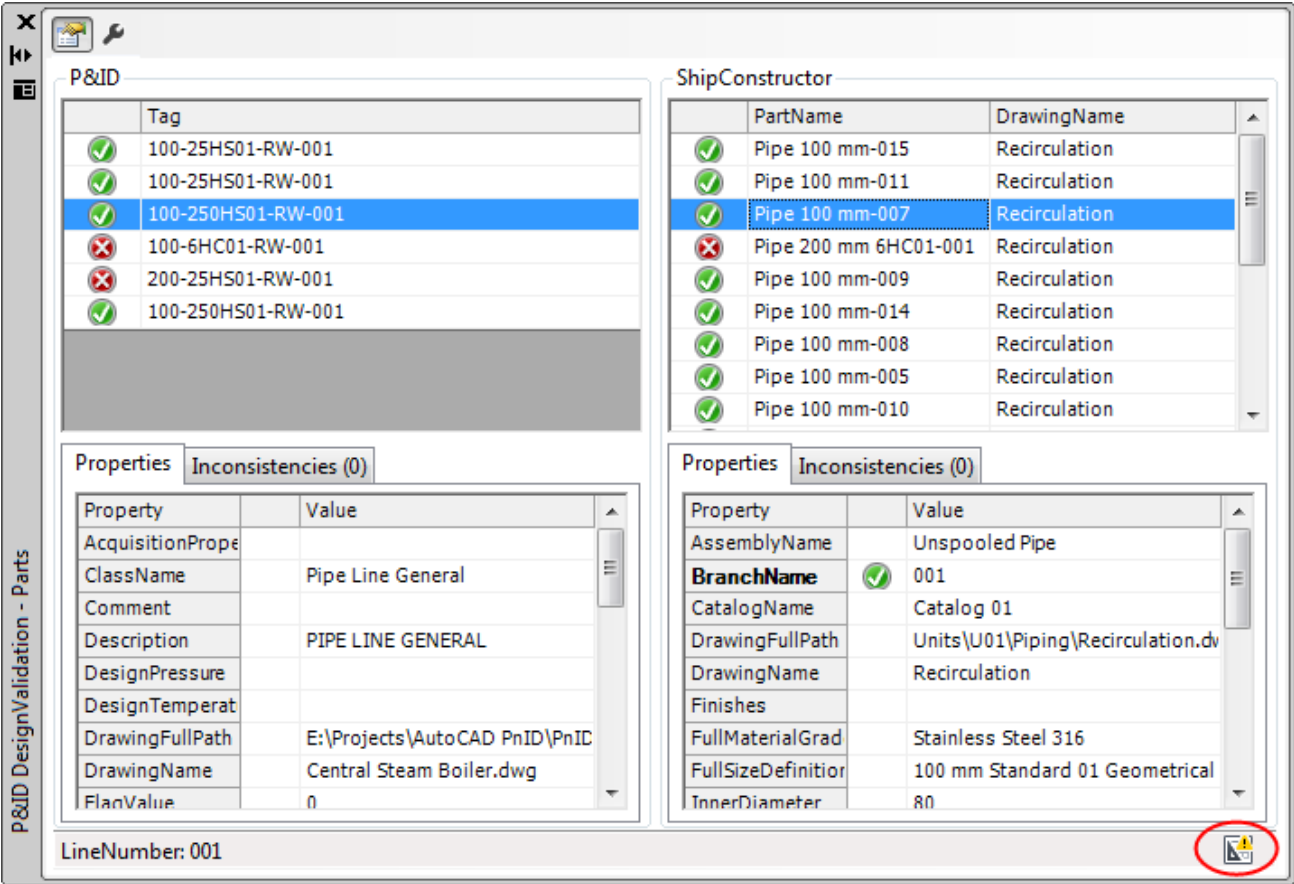
In the drawing tools palette, the user can manage auto-zooming and auto-selection behavior for objects shown in the Detailed View. Assuming that the currently selected object is visible in the currently-opened drawing, auto-zoom and auto-select will assist the user with finding the object in the drawing. If the currently-selected object is not in the currently-loaded drawing, nothing will happen, but the notification icon will appear in the status bar of the Detailed View palette.



Notification Icon Showing that Part is not in Current Drawing

To open the drawing containing the part, the user can either click the “Open Drawing...” button in the “Drawing Tools” palette, or use a similar context menu option.

Note that zooming and selecting parts is only supported in the Model Space. If the drawing is in the Paper Space, auto-navigate to the part won’t happen, but an icon will appear in the status bar of the Detailed View palette.

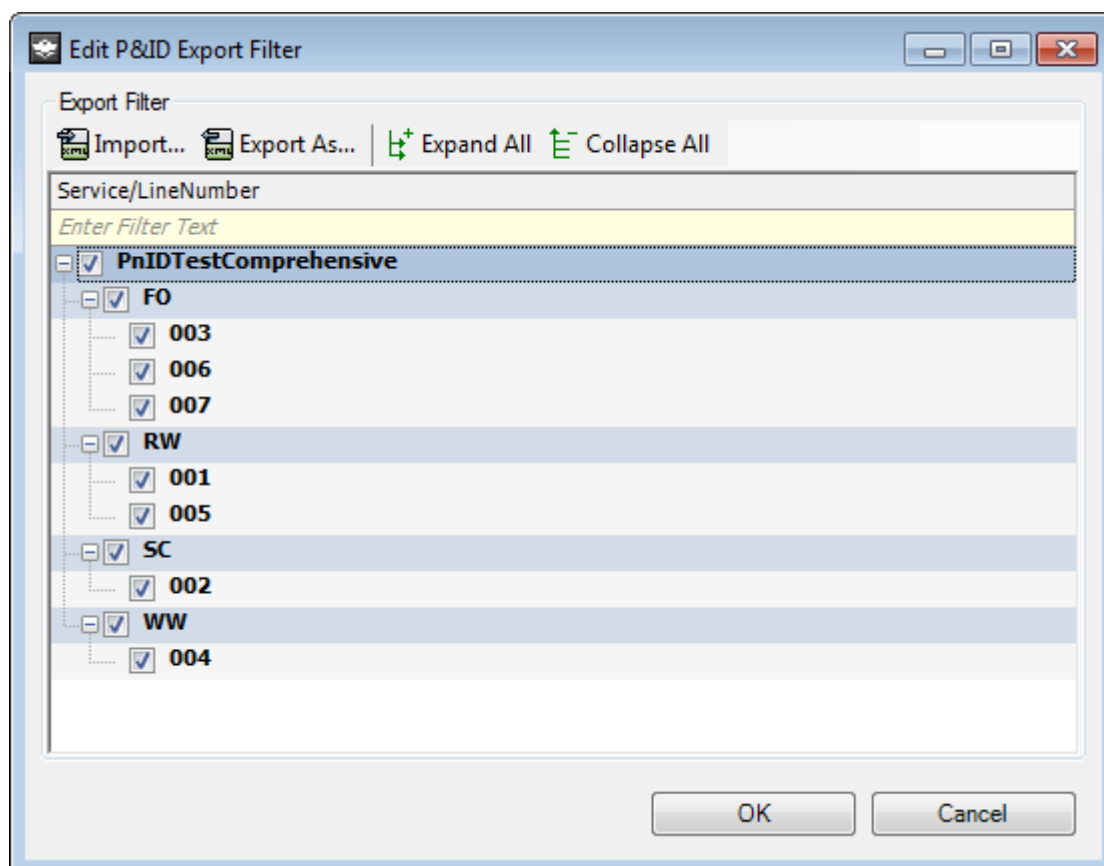


Notification Icon Showing that Paper Space View is Enabled

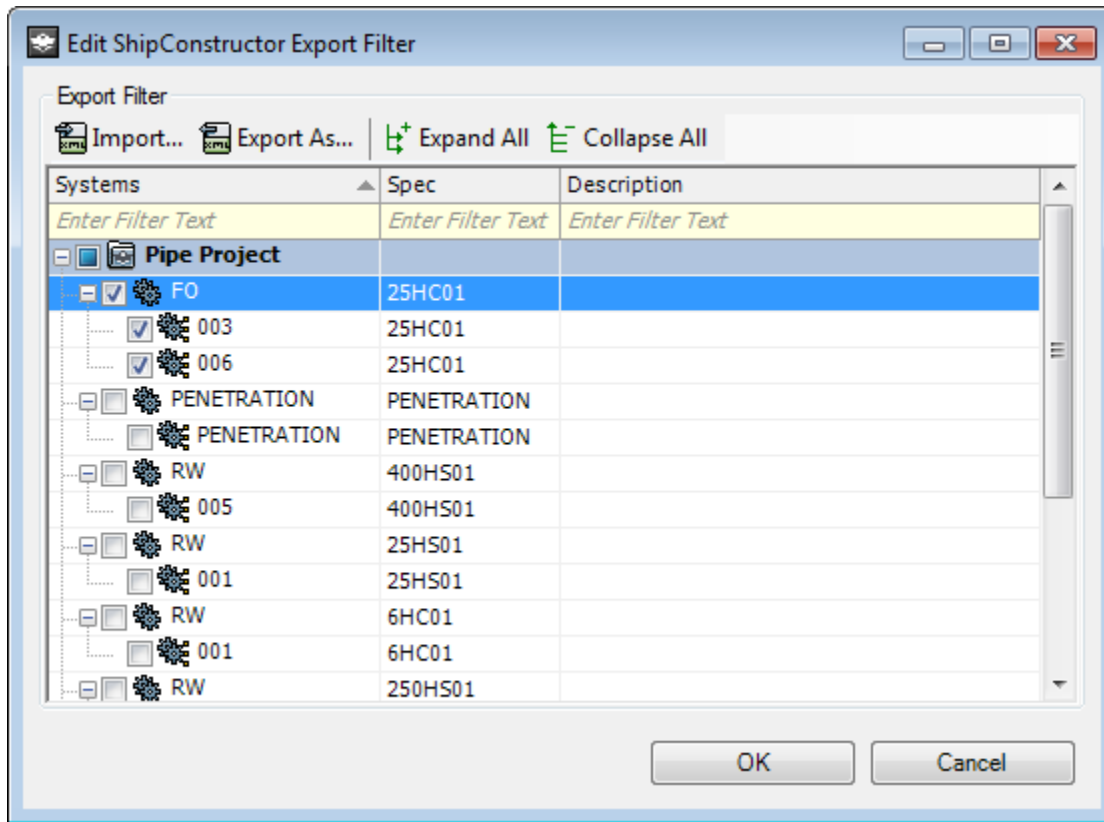
Finally, similar to the Composite View palette, the Detailed View palette allows the user to manage the list of visible columns. The access to the “Edit Columns” dialogue is provided from the context menu. To open the context menu, the user needs to right-click the header row in the object list inside the Detailed View palette.

Filter Dialogues

P&ID DesignValidation provides access to two filter dialogues that replicate Step 2b and Step 3b pages of Setup Wizard. To open the filter dialogue for the P&ID side, the user needs to type in the SCPNIDFILTERPNID command. To open the filter dialogue for the ShipConstructor side, the user needs to type in the SCPNIDFILTERDS command.



Filter Dialogue for P&ID Side



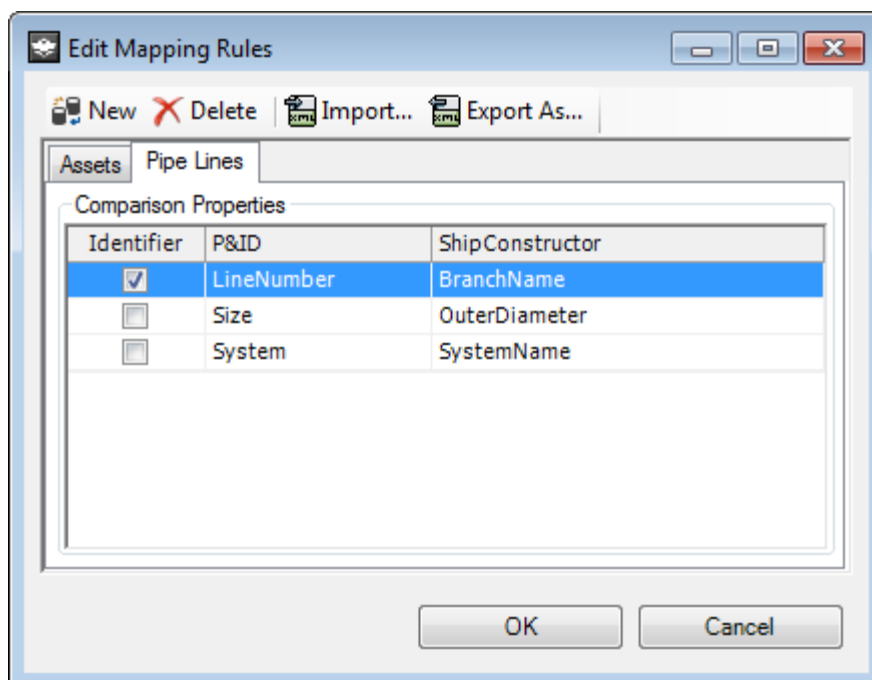
Filter Dialogue for ShipConstructor Side

Similar to the functionality available in Setup Wizard, filter definitions can be exported from and imported to the filter dialogues through XML files. Other standard controls such as Expand All and Collapse All also present in each dialogue.

Note that any changes performed in filter trees will only be applied if the user closes the dialogue with the “OK” button. If the user presses “Cancel” to dismiss the dialogue, all changes will be discarded.

Mapping Rules Definition Dialogue

The Edit Mapping Rules dialogue is called by the SCPNIDMAPPINGS command. The controls layout and the functional purpose of the dialogue are identical to those of the Step 4 page in Setup Wizard. In the “Edit Mapping Rules” dialogue, users can add, delete, and select identifier mapping rules as well as import and export data through XML files.



Edit Mapping Rules Dialogue

Note that any changes performed in the “Edit Mapping Rules” dialogue will only be applied if the user closes the dialogue with the “OK” button. If the user presses “Cancel” to dismiss the dialogue, all changes will be discarded.

Online Support for P&ID DesignValidation

For latest updates on P&ID DesignValidation which may include information about best practices or known issues, please refer to online Knowledge Base: <http://kb.shipconstructor.com/x/JAFF>

Index

No index entries found.