Re-Implement Relief Valves as Hand Valves

AutoCAD P&ID 2014

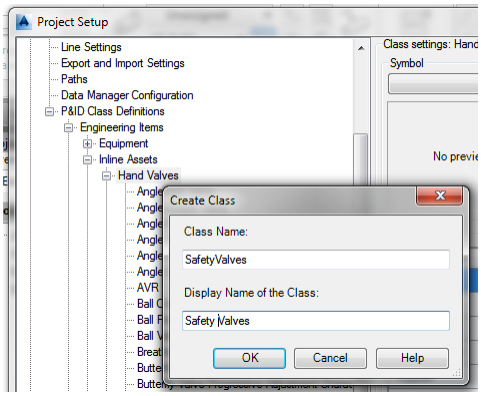
AutoCAD P&ID provides support for inline valves that have different inlet and outlet sizes in the Relief Valves class of the P&ID class hierarchy. However, the Relief Valves class is defined as a subclass of Inline Instrument. Because of this classification, Relief Valves are not included in the standard Valves List report and are instead listed as instruments in the Instrument List report.

This white paper describes how to re-implement relief valves as a subclass of Hand Valves and thus facilitate their inclusion in the Valve List report.

Create new subclass of Hand Valves

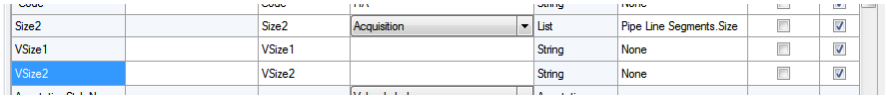
As we may need to support multiple types of relief valve, we will create a new container class below Hand Valves in the class hierarchy and implement our different types of relief valves within that class.

We cannot re-use the name Relief Valves for our new class as that is already in use. Instead, we will create a subclass of Hand Valves called SafetyValves and add all of our customisation to that class.



Add new Size Properties

We need to add three new properties to the SafetyValves class through Project Setup. These new properties will be ‘Size2’, ‘VSize1’ and ‘VSize2’. The existing property ‘Size’ and will also be used by our implementation.

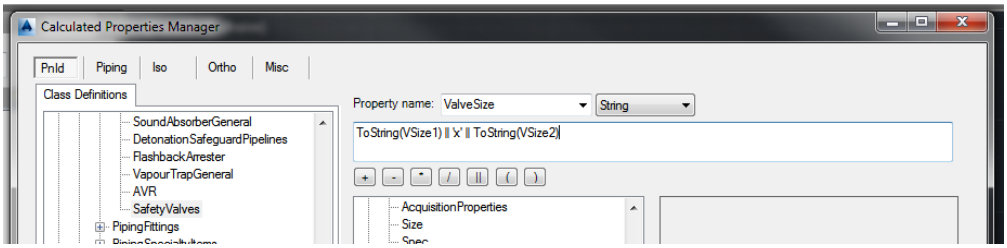


- Size – An existing List type property, will acquire the size of the inlet connection to the valve from the attached Pipeline
- Size2 – A List type property, will acquire the size of the outlet connection from the valve from the attached Pipeline – we will initially define this as an Acquisition property to be an exact copy of the Size property.

- VSize1 – A String property, is required to acquire the size of the inlet connection to the valve from the attached Pipeline into a form that we can include in the size definition of the valve. VSize1 will be readonly and will not be visible to the user – we will create this as a String property initially.
- VSize2 – A String property, is required to acquire the size of the outlet connection to the valve from the attached Pipeline into a form that we can include in the size definition of the valve. VSize2 will be readonly and will not be visible to the user – we will create this as a String property initially.

Add ValveSize Property

We will add a further property called ValveSize which will report the size of the valve in the form "inlet size x outlet size". We will add this as a calculated property using the command PLANTDEFINECALCPROPERTIES.



- ValveSize – A calculated string property, will show the size of the valve and is defined as shown above as the string concatenation of VSize1 x VSize2.

We have to use VSize1 and VSize2 to generate the ValveSize as we are unable to access the values of the Size and Size2 properties directly.

Customise Acquisition Rules

Now that we have defined the new properties we require, we need to modify the acquisition rules for the Size and Size2 properties and define new rules for the VSize1 and VSize2 properties. We are not able to do this through Project Setup and must update one of the project configuration files manually. Before we do this, we must close the project in AutoCAD P&ID.

All user-defined acquisition properties and acquisition rules are stored in an XML format configuration. The name of the configuration file varies depending upon the standard upon which the project is based. Although the initial part of the filename varies, it always ends in 'PnIdPart.xml' and is located in the project folder. The file for a metric project will bear the prefix 'DIN_', 'ISO_' or 'PIP_Metric_'. In our case, we have a metric project based on the PIP standard, so we need to look for the file 'PIP_Metric_PnIdPart.xml'.

We can edit the file using Notepad or any other text editor. When we have opened the file we need to find the following section, searching for the word SafetyValves should locate this in the file. This is the definition of the acquisition rule for the Size2 property.

```
<PnPRule xsi:type="PnPPropertyAcquisitionRule">
  <Name>SafetyValves.Size2_PnPPropertyAcquisitionRule</Name>
  <Classname>SafetyValves</Classname>
  <Operator xsi:type="PnPAnyRelatedTableColumn">
    <TableName>PipeLines</TableName>
    <ColumnName>Size</ColumnName>
  </Operator>
  <InitializeOnly>false</InitializeOnly>
  <NotOverridable>false</NotOverridable>
  <ColumnName>Size2</ColumnName>
</PnPRule>
```

We need to delete the above rule and replace it with 4 new acquisition rules as follows:

```
<PnPRule xsi:type="PnPPropertyAcquisitionRule">
  <Name>SafetyValves.Size_PnPPropertyAcquisitionRule</Name>
  <Classname>SafetyValves</Classname>
  <Operator xsi:type="PnPRelatedTableColumn">
    <RelationshipTypeName>LineEndAsset</RelationshipTypeName>
    <SourceRole>Line</SourceRole>
    <TargetRole>Asset</TargetRole>
    <TableName>PipeLines</TableName>
    <ColumnName>Size</ColumnName>
  </Operator>
  <InitializeOnly>false</InitializeOnly>
  <NotOverridable>false</NotOverridable>
  <ColumnName>Size</ColumnName>
</PnPRule>

<PnPRule xsi:type="PnPPropertyAcquisitionRule">
  <Name>SafetyValves.Size2_PnPPropertyAcquisitionRule</Name>
  <Classname>SafetyValves</Classname>
  <Operator xsi:type="PnPRelatedTableColumn">
    <RelationshipTypeName>LineStartAsset</RelationshipTypeName>
    <SourceRole>Line</SourceRole>
    <TargetRole>Asset</TargetRole>
    <TableName>PipeLines</TableName>
    <ColumnName>Size</ColumnName>
  </Operator>
  <InitializeOnly>false</InitializeOnly>
  <NotOverridable>false</NotOverridable>
  <ColumnName>Size2</ColumnName>
</PnPRule>

<PnPRule xsi:type="PnPPropertyAcquisitionRule">
  <Name>SafetyValves.VSize1_PnPPropertyAcquisitionRule</Name>
  <Classname>SafetyValves</Classname>
  <Operator xsi:type="PnPRelatedTableColumn">
    <RelationshipTypeName>LineEndAsset</RelationshipTypeName>
    <SourceRole>Line</SourceRole>
    <TargetRole>Asset</TargetRole>
    <TableName>PipeLines</TableName>
    <ColumnName>Size</ColumnName>
  </Operator>
  <InitializeOnly>false</InitializeOnly>
  <NotOverridable>false</NotOverridable>
  <ColumnName>VSize1</ColumnName>
</PnPRule>

<PnPRule xsi:type="PnPPropertyAcquisitionRule">
  <Name>SafetyValves.VSize2_PnPPropertyAcquisitionRule</Name>
  <Classname>SafetyValves</Classname>
  <Operator xsi:type="PnPRelatedTableColumn">
    <RelationshipTypeName>LineStartAsset</RelationshipTypeName>
    <SourceRole>Line</SourceRole>
    <TargetRole>Asset</TargetRole>
    <TableName>PipeLines</TableName>
    <ColumnName>Size</ColumnName>
  </Operator>
  <InitializeOnly>false</InitializeOnly>
  <NotOverridable>false</NotOverridable>
  <ColumnName>VSize2</ColumnName>
</PnPRule>
```

Having added the acquisition rules, we now need to add the triggers that will cause the acquisition rules to update. We need to find the following section in the file; this is the trigger for the Size2 property.

```
<PnPTrigger>
  <Name>PipeLines_Update_SafetyValves.Size2_PnPPropertyAcquisitionRule</Name>
  <RuleName>SafetyValves.Size2_PnPPropertyAcquisitionRule</RuleName>
  <TableName>PipeLines</TableName>
  <Action>Update</Action>
  <Target>Related</Target>
</PnPTrigger>
```

We must add the following triggers to the file immediately after the above section:

```
 <PnPTrigger>
   <Name>PipeLines_Update_SafetyValves.Size_PnPPropertyAcquisitionRule</Name>
   <RuleName>SafetyValves.Size_PnPPropertyAcquisitionRule</RuleName>
   <TableName>PipeLines</TableName>
   <Action>Update</Action>
   <Target>Related</Target>
 </PnPTrigger>

 <PnPTrigger>
   <Name>PipeLines_Update_SafetyValves.VSize1_PnPPropertyAcquisitionRule</Name>
   <RuleName>SafetyValves.VSize1_PnPPropertyAcquisitionRule</RuleName>
   <TableName>PipeLines</TableName>
   <Action>Update</Action>
   <Target>Related</Target>
 </PnPTrigger>

 <PnPTrigger>
   <Name>PipeLines_Update_SafetyValves.VSize2_PnPPropertyAcquisitionRule</Name>
   <RuleName>SafetyValves.VSize2_PnPPropertyAcquisitionRule</RuleName>
   <TableName>PipeLines</TableName>
   <Action>Update</Action>
   <Target>Related</Target>
 </PnPTrigger>
```

That completes the acquisition property definitions for our new SafetyValves class. We now save and close the file before we re-open the project in AutoCAD P&ID and return to Project Setup

Complete the Configuration

We will review the property definitions and change the display names of the Size and Size2 properties to Inlet Size and Outlet Size respectively; we will also set the readonly and visibility attributes for the VSize1, VSize2 and ValveSize properties.

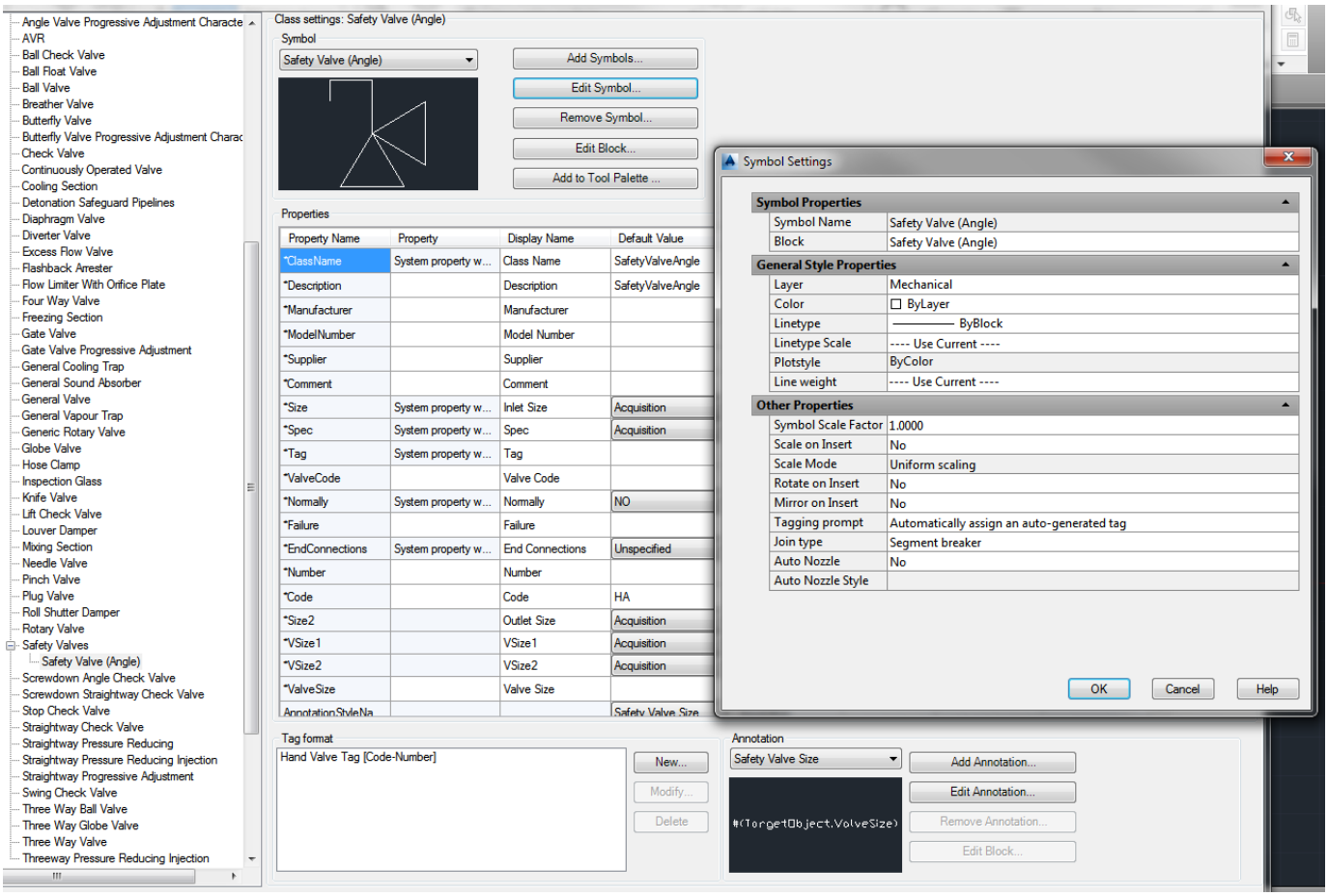
*Size	System property w...	Inlet Size	Acquisition	List	Pipe Line Segments.Size	☐	☑
*Spec	System property w...	Spec	Acquisition	List	Pipe Line Segments.Spec	☐	☑
*Tag	System property w...	Tag		String	None	☐	☑
*ValveCode		Valve Code		String	None	☐	☑
*Normally	System property w...	Normally	NO	Symbol List	None	☐	☑
*Failure		Failure		String	None	☐	☑
*EndConnections	System property w...	End Connections	Unspecified	List	None	☐	☑
*Number		Number		String	None	☐	☑
*Code		Code	HA	String	None	☐	☑
Size2		Outlet Size	Acquisition	List	Pipe Line Segments.Size	☐	☑
VSize1		VSize1	Acquisition	String	Pipe Line Segments.Size	☑	☐
VSize2		VSize2	Acquisition	String	Pipe Line Segments.Size	☑	☐
ValveSize		Valve Size		String	None	☑	☑

To complete the configuration, we will add the Annotation Style 'Safety Valve Size' to display the ValveSize property.

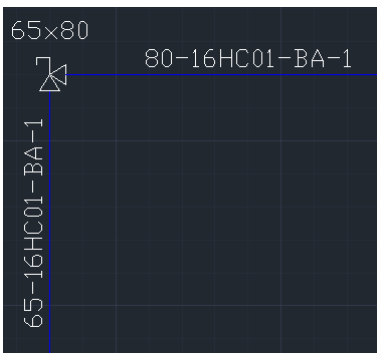
Create Subclass(es) of Safety Valves

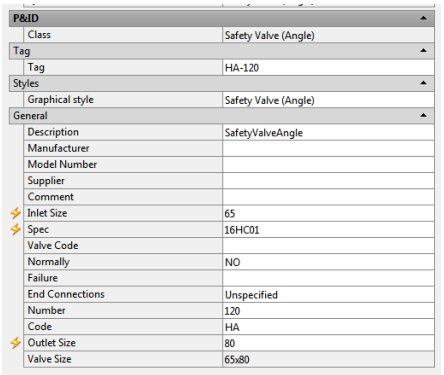
Having defined all of the functionality that we need for all of our relief valves in the SafetyValves class, we can implement the different types of relief valve we require as subclasses of SafetyValves.

For example, we will create an angled safety valve and call it Safety Valve (Angle). Note that we must set the Symbol property 'Join type' to 'Segment breaker' to enable us to assign different pipeline sizes to the inlet and outlet connections.



We can add the new symbol to the toolbar and try it out.





Our Safety Valve (Angle) is now included in the Valve List report.